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THE REFLECTOR—THE TELESCOPE OF THE FUTURE.—[See page 30.]

Design of a five-foot reflecting telescope, showing how compact is the entire installation.

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Panama Canal Architecture

IT is reassuring to learn from the last issue of the Panama *Canal Record* that the architectural features of the Panama Canal, both as to landscape and buildings, are in the hands of an architectural firm of note, the character of whose past work is a guarantee that the Panama Canal is not to be belittled by amateur architecture.

Too often in the past American engineering works of magnitude have suffered either from disregard or misapprehension of their architectural and æsthetic requirements. The outlines and masses which result from the strictly utilitarian principles of design which govern the engineer are frequently inharmonious and displeasing to the eye, and do violence to an æsthetic sense whose demands are becoming more insistent with the general spread of knowledge and artistic education. Sometimes, as in the case of the Brooklyn Bridge, a great engineering work is as ornamental as it is useful, and sometimes as is the case in the Williamsburg Bridge—surely the ugliest structure of its kind in existence—the result is artistically deplorable.

In our issue of February 8th of this year, we drew attention to the fact that the Panama Canal was in danger of being cheapened by the crude character of some of the structures which were being erected, and to prove our contention, we illustrated a range or light tower, which had been built on the center wall of the lake approach to the Gatun Locks. This structure, designed in the offices of the engineering force at the Isthmus, is no doubt strong, stable and perfectly adapted to its purpose of showing a light in a certain location at a fixed elevation for all time to come; but considered as an architectural work it is about as ugly and inharmonious a piece of design as mortal eye ever looked upon. We had hoped that by this time the tower had been replaced, either by a more graceful design in reinforced concrete, or by a steel tower of open work construction similar in general outline to the Eiffel Tower. We understand, however, that any change in this direction is strongly opposed by the engineer in charge of that particular class of work.

The SCIENTIFIC AMERICAN commends this matter to the serious attention of the chairman of the Isthmian Canal Commission, in the hope that he will authorize the expenditure of the relatively small amount of money that will be necessary to remove the present structure from its very conspicuous position and put in its place something that would be consistent with the dignity and great excellence of the engineering work at the Gatun Locks.

A Suggestion for Suburban Traffic

IN a letter in the New York *Times*, Mr. W. J. Wilgus suggests a method by which the capacity of the railroads which carry a large commuter traffic into and out of our cities might be rendered capable of handling a larger number of passengers, on a more frequent schedule, at higher speed, and at a considerably reduced rate.

The proposal carries additional weight when it is known that Mr. Wilgus was the chief engineer of the New York Central Railroad, who first proposed the utilization of the "air rights" of the company's terminal grounds, by building a double deck station, and covering the space above with business and other city buildings. He now proposes that the railroads should further utilize their air rights by building above their surface express and freight tracks, elevated structures reserved for a high-speed, electric, suburban service. The railroads that connect our cities with the outer world, says this authority, have not as yet seen the wisdom of departing from the time-honored custom of utilizing the surface only of their lands for tracks. The result of running over these tracks a heterogeneous mass of trains—express passenger, local passenger, and freight, is that the express and limited trains are given the right of the road and commuter and freight trains have to drag along as best they may. This intermingling of traffic has produced such dissatisfaction among the commuting public and shippers of merchandise, that many railroad managers have publicly declared that they wish they might be entirely relieved from the obligation of serving suburban communities.

Another difficulty is that the concentration of local travel within the rush hours of night and morning results in the railroad plant being rarely used to more than ten per cent of its full capacity; which, in turn, imposes the need for comparatively high fares with which to pay unproductive fixed charges.

The construction of separate overhead tracks would not only lengthen the distance to which the commuter could travel within an hour's time, but, through suitable co-operation with municipalities, the old-fashioned concentration of travelers at congested terminal centers might be replaced by a system of marginal subways, or elevated routes, that would permit of a ready circulation of travel in the cities, with frequent stops in the business and manufacturing centers.

To cheapen the cost of service, a graduated range of fares is suggested for the different hours of the day—comparatively high rates in the rush hours, with lessening charges before and after such hours. Mr. Wilgus states that an increase from ten per cent of the railroad's twenty-four hour capacity to 20 per cent, would cut the fixed charges per passenger in half and reduce the total cost by some 25 per cent. By thus separating the commuter from the heavier and more ponderous trunk line service; by affording unobstructed circulation of trains in the cities; and by graduating the fares so as to distribute the "peak" or highest load of traffic over longer periods of the day, the rapidity of suburban service would be increased, its cost would be decreased, and a larger number of city workers with their families could live among more congenial and healthful surroundings.

Is the Supremacy of the Battleship Challenged?

AT the present stage of the development of naval warfare the battleship is supreme, or to speak more conservatively, it is believed to be supreme. In our own navy, at least, it is held that in spite of the high degree of perfection to which the other various units of offensive and defensive warfare have been carried, the issue of a naval campaign can be definitely decided, only when battleship is lined up against battleship in the final supreme test.

Now, although the general proposition that a naval war can only be won by the destruction of the enemy's battleship fleet is undoubtedly correct, it is not equally certain that battleships can be destroyed only by battleships. So great has been the development of the existing smaller units of warfare, and so pregnant with possibilities are some of the newer means of attack, notably by the aeroplane and the dirigible, that the question arises as to whether the final outcome of a naval campaign lies so completely with the battleship fleet as is commonly believed. Thus the torpedoboat destroyer has developed in size, speed and efficiency to a point which entitles it to be called not the torpedoboat—but the battleship-destroyer. Destroyer fleets are now composed of boats so fast, so seaworthy, and so ably handled, and they are employing tactics and devices so novel and bewildering to the enemy, that the time has gone by when they have to wait for the cover of night or fog in order to make a successful attack at close quarters. It was only last year that our daily press reported a successful attack by destroyers on a battleship fleet, made under the bright light of a noonday sun. Under the methods employed, the destroyers found themselves steaming at thirty knots parallel with the battleship line at a distance of not over 2,000 yards (which is point-blank torpedo range), and they were doing this with a clear vision of the position of the enemy's individual ships, and under conditions which rendered it impossible for that enemy to locate the position of the destroyers or deliver any effective fire against them.

During a recent interview with a German naval officer, the statement was made to the writer that although the great superiority in battleships of the British navy would render it likely in the eventuality of hostilities that the German navy would be crushed, the high degree of efficiency of the German torpedo fleet was such, that the victory would be won at a cost which would relegate the British fleet to second position among the world's navies—a result which we consider to be entirely possible.

Another of the lesser units of warfare which is boldly challenging the battleship supremacy is the submarine. Recent maneuvers of an arduous and extended character have proved that the submarine is safe, seaworthy, accurate, and capable of thorough control. Its radius of action is being very rapidly increased, as are also its size and its above-water and under-water speeds. For many years we have believed that the submarine would ultimately develop to a size and speed which would enable it to cruise with battleship fleets upon the high seas. If the day ever comes when two opposing fleets line up at, let us say, ten or twelve thousand yards battle range, each battleship with a fifteen to seventeen-knot submerged speed submarine under its lea, it will be entirely possible that the issue of the day will be decided, not by gun fire, but by the 40-knot torpedo discharged from submarines at point-blank range.

And now comes Rear-Admiral Fisk with his bold proposal to substitute the 50-mile aeroplane for the 15-mile submarine. Fisk would carry the torpedo strapped below the body of the aeroplane, from which it would be dropped by releasing a latch. In delivering the attack, the aviator flies at a high elevation to within point blank range of the battleship. He then swoops rapidly downward to within ten or fifteen feet above the water, directing his flight so that on reaching the proper elevation, the torpedo bears true on the target. The latch is then released and the torpedo engine, started by the act of releasing, drives the missile straight for the mark.

Now every gunner knows how difficult it is to judge a range that is rapidly changing both its vertical and horizontal position. To hit the aeroplane during its downward flight would be a matter of pure good luck. No spotter would be available to send corrections to the range-setter, and any gunner must admit that, if an aeroplane could be built of sufficient power to carry a torpedo in the manner proposed, such a form of attack would present great possibilities.

This article must not be taken as a plea for reducing the size, gun-power or weight of armor of the present battleship. We must meet displacement with displacement, speed with speed, and gun with gun, if we are not to be found wanting in the day of trial. The next five years will see a remarkable development in the three methods of attack above outlined, and it will take another battle of Tsushima to determine whether our present "Nevadas" and "Pennsylvanias" are the best types to meet the average conditions of modern warfare, or whether there must be a revision of type, such as resulted from the lessons of that famous conflict in the sea of Japan.

Experiments in Electroculture

THE stimulation of plant growth by means of electrical currents has now been carried on over a period of 167 years; and to this day it is hard to point to any tangible and generally applicable results of these investigations, nor has this mode of cultivation yet entered into the calculations of the ordinary agriculturist or horticulturist. In a voluminous work on electroculture recently published by Dr. A. Bruttini of Rome it is stated that 187 persons are known to have carried on experiments in this field. Of these, 133 reported favorable results, 21 were doubtful, while 33 found the application of electricity to plants to be distinctly unfavorable. A majority of the first group employed more or less unscientific or superficial methods. Nevertheless electroculture continues to be the cherished dream of many present-day experimenters, as is witnessed by the fact that an "International Congress of Electroculture" was held at Rheims last autumn.

Micrometer Observations of Phoebe, the Ninth Satellite of Saturn.—In No. 4651 of the *Astronomische Nachrichten*, Prof. E. E. Barnard of Yerkes Observatory publishes the results of observations made with the 40-inch reflector at a time when Saturn was 26 degrees higher on the meridian than when the stellite was discovered in 1906. "The satellite was sought for on the night of December 8th. After making a sketch of the 5½′ field," Prof. Barnard states, "I began measuring the faint stars. It was then noticed that a star marked 14th magnitude, close north preceding a 12½ magnitude star was changing its position. This proved to be Phoebe. A similar case occurred on December 31st, when I had marked it 14th magnitude on a sketch and had measured a much fainter star for the satellite." Prof. Barnard concludes that when the seeing is good Phoebe must easily have been as bright as the 14th magnitude. "Under similar conditions it should be observable with moderate sized instruments." Prof. Barnard states that the satellite is following almost if not exactly, the ephemeris of Dr. F. E. Ross, given in the American Ephemeris.

Engineering

Dreadnoughts Shoot Better Than Pre-Dreadnoughts.—The British return of the tests of gun-layers for last year shows considerable improvement in the marksmanship of dreadnoughts; it shows also that the larger the gun the greater is the accuracy. The percentage of hits out of rounds fired is: for the 13.5-inch, 57.9; 12-inch, 51.3; 9.2-inch, 53.2; 7.5-inch, 47.1; 6-inch, 50.9. It is estimated that out of 403,750 pounds of metal fired from dreadnought ships, 233,000 pounds, or 57.7 per cent, struck the target.

Air for Submarines.—The use of peroxide of sodium for renewing the air in the confined quarters of submarines, which was first promoted in France by Profs. Desgrez and Balthazard in 1897 and since then adopted in the British navy, has been lately tried with oxylithe on board the submarine "Argonaute" of the French fleet at the naval establishment of Toulon. On this occasion the submarine remained under water for 12 hours. It contained a crew of 21 officers and men, together with the two members of the testing commission, and the results as a whole were recognized to be excellent.

Protecting Iron and Steel from Corrosion.—In an industrial note United States Consul Albert Halstead of Birmingham tells of a process for protecting iron and steel from corrosion which was called "ferro-zincing" or "ironizing" and is a cold electric process. It is claimed to be suitable for coating plates, angles and channel iron, built up structures, tubes and cylindrical vessels, bolts and nuts, small castings and forgings. It is said to be cheaper than other similar processes, the cost being dependent upon the nature of the articles and the thickness of the coating required.

A Tidal Ferry.—A new type of steam ferry has lately been put in use at the port of Hamburg. It somewhat resembles a craft used in England for a few years past, and is characterized by the fact that the main deck is movable and can be raised or lowered by as much as 15 feet, the deck being strong enough to carry six large hauling wagons. The daily variations in the tide level at Hamburg made this kind of ferryboat necessary. Of 170 tons displacement, the new ferry is 120 feet long and 50 feet wide and carries triple-expansion engines giving 650 horse-power. When the boat enters the wharf it comes into a small and completely sheltered dock.

Twenty-seven Miles of Subway Constructing.—The last report of the Public Service Commission for the month ending June 15th shows that eighty-one million dollars is being expended on twenty-seven miles of the New York rapid transit subway. Since practically all of it will have four tracks, it can be said that about one hundred miles of single track is under construction. The work is being done by fourteen contracting firms, who give employment daily to some six thousand men. Of this work, the Fourth Avenue subway and the Center Street loop between the Williamsburg and Brooklyn bridges are practically completed.

What Might Have Been.—A striking comparison is drawn by our contemporary *The Navy* between our foreign trade carried in American ships in 1826 and to-day. Attention is drawn to the fact that if the waterborne foreign trade of the United States were per capita equal to that of Great Britain it would amount to $14,000,000,000 per annum and if our foreign carrying trade in American ships were the same proportionately as it was in 1826, when it was 90 per cent of our total foreign trade, it would amount to-day to $12,600,000,000. Last year, as a matter of fact, it amounted to only $322,451,565.

Two Thousand Engineers Wanted.—Attention is drawn by the *Engineering Record* to the fact that the recent act of Congress authorizing the valuation of railways institutes a work so large that probably about two thousand engineers will be needed to fill positions ranging from those of a minor character in field parties to the responsible work in charge of divisions. All of the positions are to be filled through civil service examinations. Engineers with the necessary training will find it to their advantage to give the forthcoming examinations careful consideration. The salaries paid for this work will probably be at least as high as those paid by the railroad companies for similar work.

Death of a Well-known Shipbuilder.—The recent death of Edwin S. Cramp, formerly vice-president of the William Cramp & Sons Ship and Engine Building Company, the second son of Charles H. Cramp, marks the death of another member of a family that will always be famous in the annals of American shipbuilding. It was his grandfather, William Cramp, who founded the large shipbuilding plant on the Delaware River. In later years it was this firm that figured so conspicuously in the upbuilding of the American navy under the *régime* of Secretary of the Navy Tracy. It was under the presidency of Mr. Cramp's father that the firm built the fast "commerce-destroyers "Columbia" and "Minneapolis," and it is to the credit of the firm that some twenty years ago the latter ship, on trial, maintained a speed of over twenty-three knots.

Electricity

High-frequency Generator.—According to recent press dispatches, an English engineer, William Durtnall, has invented an electric generator designed to produce heavy current with an alternating frequency of some 30,000 to 100,000 oscillations per second. If this be true the generators should play an important part in wireless telegraphy and telephony.

Bird Perches on Line Poles.—In the rules and regulations for bare transmission lines, published by the German Association of Electrical Engineers, it is prescribed that the poles and cross arms of transmission lines be so designed as to provide no footing for birds. In carrying out this regulation a German firm has designed a pole provided with a perch at the top on which the birds may roost. The perch is merely a T projecting from the pole proper, the latter being provided with a conical cap, so as to afford no footing for the birds. While the brackets and cross arms are not absolutely devoid of roosting places they do not offer as attractive a perch as the T at the top of the pole.

An Electric Lamp for the Dark Room can be placed very conveniently beneath a transparent glass dish for use in developing plates. Photographers know the inconvenience of having constantly to remove the plate and hold it up to the light to see whether it is finished. This can be avoided by cutting out a square opening in the bench, covering it with a glass plate, then putting one of the usual pressed glass trays upon this as a support. Under the table is an electric lamp arranged to give a red light. A somewhat strong light can be used, flashing it on momentarily by a foot or knee push, or any suitable switch. The usual dark-room lantern can also be retained, putting on one or the other light when need be.

Wireless Determination of Longitude.—In a paper read before the British and French electrical engineers at Paris, Commandant G. A. Ferrie described the system employed in sending out time signals from the Eiffel tower, whereby even an unskilled person can estimate how much his clock or watch is fast or slow to within half a second. He also described the recent experiments conducted between the Eiffel Tower Station at Paris and the Arlington Station at Washington to determine the difference of longitude between the two cities. The experiments are to be resumed next fall, and by using photographic galvanometers with rapid vibrations superimposed by a tuning fork, it will be possible to measure to within 0.001 second.

X-ray Moving Pictures.—Moving picture views made with the X-rays are quite a novelty, and the German scientist Dessauer now succeeds in producing them by an apparatus of his make which gives such powerful X-rays that he can take six photographs a second in this way, and he works a cinematograph which shows the movements of swallowing, the throbbing of the heart, and the like. The apparatus for producing the powerful X-rays employs an improved current breaker in the primary of an induction coil which gives rapid break and enables him to secure secondary current from the coil of much higher power than usual. Using this device in connection with an X-ray tube he obtains rays which enable sharp and rapid radiographs to be taken.

Direct v. Alternating Current Between Trollhatten and Copenhagen.—In estimating the cost of generating and transmitting current from Trollhatten to Copenhagen a three-phase, 100,000-volt line and a direct-current 90,000-volt system were considered. The latter which called for 20 generators in series, under the Thury constant-current system, was found more economical and was adopted. Its chief advantage lay in the ability to transmit current under water without transformer stations, two cables being employed instead of four cables as would be required in the alternating scheme. The alternating system would call for three transformer stations and a frequency-converter station, converting from 25 cycles to 50 cycles. According to estimates made, the continuous current system shows a saving of $400,000 on the cost of installation and $40,000 on the annual cost. The distance from Trollhatten to Copenhagen is 204 miles, three miles of which is under water.

New Electric Locomotives for Swiss Railroads.—The Swiss Federal railroads are soon to make use of two electric locomotives of a new type which are now in construction at the Brown-Boveri works and are intended to work on three-phase current. The new locomotives have two newly-designed electric motors of 1,000 horse-power size. Four driving axles are used, with driving wheels coupled on a new system, and this allows of raising the motors on the locomotive truck so that they can be more readily inspected than heretofore. This also raises the center of gravity as experience shows to be necessary for good running. The truck has two non-driven axles. The driving wheels are 4 feet 2 inches in diameter and the idle wheels 2 feet 8 inches. Four speeds are given the locomotive by modifying the number of pairs of poles in the motor by proper electrical connections for giving 6, 8, 12, and 16 pairs so as to run at speeds between 18 and 45 miles an hour. The locomotive can develop as high as 2,800 horse-power at full speed.

Automobile

Kerosene Taxable Abroad.—Whether kerosene as motor fuel ever is taxed in England, as several times has been hinted would be the case, the possibility is at least likely. The Home Secretary recently has stated that under present laws it is taxable under the definition of motor spirit, provided it comes into general use and gives evidence of proving reasonably efficient fuel.

Berlin's Motor Cabs Increasing.—Recent traffic returns for the city of Berlin indicate that the number of motor cabs at present in service is 1,218, as compared with 1,065 a year ago. On a like basis of comparison, the horse-drawn variety numbered 3,298 a year ago and 2,773 at present. In other words, while the number of motor cabs increased by 153, the number of horse-drawn cabs decreased by 525.

Killing Two Birds With One Stone.—In line with the clever foreign practice of combining the manufacture of motor cars with the production of sewing machines and guns and what-not, one British dealer has developed an unusual scheme for reducing "overhead expenses." He uses his demonstrating cars also for hire purposes and in this way makes them pay the expense of demonstrating, which in many cases is high.

Supplying Steam to Carbureter.—Patent No. 1,059,967, granted to Harry A. Babbitt of Little Rock, Arkansas, provides means by which steam may be injected into the carbureter of an internal-combustion engine for increasing the efficiency of the explosive charge and regulates such supply of steam, the steam being derived from the overflow water from the jacket by heating it by the exhaust.

A Gasoline-electric Truck.—A somewhat novel European combination is that of a power wagon and an electric-car truck. The truck is designed so as to allow of carrying the loaded power wagon bodily and thus transporting it over the tramway rails to the railroad depot, where the load is charged upon the railroad cars, then the empty wagon comes back by the tramway as before. This effects a saving in wear, for the distance from the place where the wagon takes on the merchandise, to the tramway, is comparatively short. All that is needed is to modify a car truck by putting on a pair of hinged channel bars in the rear which can be let down so as to form skids upon which the power wagon may be drawn up by means of a winch.

Motoring Increasing in Switzerland.—Despite the numerous obnoxious laws that have been leveled at the heads of motor tourists in some parts of the republic of Switzerland, recent returns show that the number of tourists visiting that country increased during the past year instead of diminishing. Altogether, some 9,000 automobile tourists entered Switzerland, the average stay being calculated at 13 days, and it is estimated that their expenditures approximated $3,000,000, which is an increase of nearly 33 per cent over the expenditures for the previous year.

Effect of London Taxicab Strike.—Although the striking drivers of London taxicabs, who but recently have returned to work, had all their demands acceded to, it probably will be a long time before the industry returns to its previous stable basis. During the time the cabs were not running, the public became more cognizant of the real value of London's excellent tube and 'bus service; the result is that there is evident hesitation to pay the heavier tolls of the taxicab men and no inconsiderable number of the metropolis's 8,000-odd cabs are running fare-less.

Novel Corner-lighting Scheme.—One ingenious motorist with a penchant for tinkering has evolved a novel and simple apparatus for casting the light beams from his head lamps around a corner. The apparatus consists of nothing more complicated than two strips of bright tin vertically supported in front of the lamps in suitable swiveling brackets. The front ends of the strips are connected and from the connection a wire leads to the steering column. Hence, it is a simple matter to turn the tin strips either one way or the other, depending upon the direction of the road; and as the strips normally are in the same plane as the light beams they do not reduce the efficiency of the lamps appreciably.

Where Standardization is Needed.—With the present method of driving speed-indicating instruments, the indicating needle shows a tendency to oscillate so rapidly as to make accurate reading difficult when the car is driven at speed over other than very smooth roads, and this feature suggests that a better method of driving them is possible. When the instrument is driven from one of the front wheels, as is the present general practice, the bouncing of the wheel, with consequent slight spinning, is reflected instantly in the meter. At least one manufacturer has solved the difficulty by the simple expedient of affixing the driving gear to the propeller shaft, and his action points out wherein a material improvement in mounting and driving can be made. Such a location requires a less flexible shaft than does the front wheel driving method and the shaft itself is less liable to be broken through accident.

The Arches of Mexico

Relics of Early Spanish Engineering

By Mary Worrall Hudson

IT will be a sorry day for Mexico when the arches that were built by the Spanish conquestadors, their descendants, and their Indian slaves, are destroyed or permitted to fall into decay.

Now, all over the country, the traveler whose eye is attuned to beauty is delighted with the springing arch, the true beauty line of architecture. The arch in Mexico is often massive rather than light—even cumbersome, perhaps; but it is always graceful. Many of them make up in masonry what they lack in scientific proportion and construction, like the old Roman arches, but by this means they have stood for two or three centuries, and will be a grateful relief to the landscape for as many more if they are permitted to endure so long. There are arches in Mexico that are as true as architectural principles could make them, and more are being built in many parts of the Republic, but it is for the preservation of the old and the picturesque that a plea should be entered at once. The old arched bridges, with a rude buttress propping each pier, are among the most interesting ruins of rural Mexico. The buttresses were almost invariably covered with plaster, as indeed is a great part of the old masonry in Mexico, but much of that has now fallen away, revealing the stone work, some of it being made up of irregular bowlders deftly packed together with a good cement, as in the old bridge at Acambaro. In the illustration may be observed a peculiarity of much of the excellent old Spanish masonry. While the cement was wet, innumerable small wedge-shaped stones were driven into it, giving the edges of these rather thick layers a speckled appearance.

In the magnificent aqueduct at Queretaro a series of beautiful arches stretches across the valley for a mile and a half, carrying to the town the pure water that its winding bed has guided from the mountains three or four miles away. It will be observed that the corners of the huge supporting columns of this aqueduct are of cut stone, all with a flat surface outward. The Mexican Central Railway passes through one of these arches, which are about eighty feet high. The whole magnificent structure, nearly five miles in length, was presented to the town of Queretaro chiefly through the generosity of one man—the benefactor whose statue stands in the pretty plaza, the Marques de la Villa del Villar de la Aguila. We present both a near and a distant view of these beautiful arches.

In the picture of the aqueduct that formerly led from the springs at Chapultepec to the city of Mexico, it will be noticed that there is a continuous base or foundation running from arch to arch, thus tying the structure together at the bottom as well as the top. These arches are large enough for ordinary vehicles to pass through, but the base of solid masonry, about two feet thick above the surface of the ground, prevented that and thus hindered traffic to such an extent that modern Mexico decreed the fall of the picturesque old aqueduct. A few small groups of arches alone remain, but there is not as much left of the comparatively modern aqueducts in the vicinity of the capital of Mexico as there is of the ancient Aqua Claudia at Rome. The destruction is a distinct loss to Mexico.

The continuous foundation that is seen in the aqueduct at Mexico city may be seen in the construction of the aqueduct at Queretaro, where the connecting base is much deeper and on portions of which there is also a water conduit.

In certain parts of Mexico the masonry is composed of large and small, or rather, thick and thin, stones laid alternately, and the spring or curve of the arch is made without wedge-shaping the large stones, by putting three layers of thin stones between the large ones at the top of the curve and two layers of thin stones between the thick ones on the under side of the curve.

Aqueduct leading from the springs of Chapultepec to the city of Mexico.

Old arch of the original bridge at Acambaro.

Aqueduct at Queretaro, arches 80 feet high.

Beautiful arches of the aqueduct stretching across the valley at Queretaro.

Artificial Pearls

THE industry of manufacturing artificial pearls has developed enormously of late years, both in extent, and in the remarkable degree of perfection which these simulacra of the natural gem have attained, some of them almost defying detection save under the close scrutiny of the keenest experts.

Hence an account of the methods employed in their making as described in *Les Annales* is exceedingly interesting.

The simplest forms are uniformly spherical and are merely glass balls blown by means of tubes of varying size. More ingenious and more natural-looking are the irregular pearls or *perles goitrenses*. To produce these the workman sometimes merely touches the ball momentarily with the end of a red-hot tube, thus melting the glass at the point of contact and drawing it out irregularly. In other cases he touches one spot or another of the ball to a flame, at the same time blowing gently in the tube.

The ball is pierced by two holes, one of which is caused by the breath of the workman, and the other by the hollow in the tube at the moment when this is detached from the pearl by means of a slight tap.

These balls are then merely coated inside with a preparation known as "essence of the Orient." This, despite its elaborate title, consists merely of pure water holding in solution the scales of the little fish known as the bleak-fish.

Artificial pearls were unknown till 1656, when a French jeweler named Jaquin, who was fond of angling, noticed that clear water which had been used to wash bleak-fish (*Cyprinus alburnus*) contained a sticky deposit consisting of the beautiful shining scales of this little fish.

The first efforts to use this in simulating pearls consisted in coating little balls of plaster or similar composition with it. But the coating quickly wore off, giving the "pearls" a sorry aspect. Attempts to make hollow beads and apply the coating to the interior were more successful as to beauty and permanence.

The operation consists in the sucking of the liquid into a tube drawn out to a fine point and then blowing it into the glass bead, which is then given a rotary motion to spread the coating evenly.

The beads when coated are placed in a sieve whose bottom is covered with parchment and shaken incessantly till dry. Finally they are filled with wax so as to be less fragile and a little heavier.

To produce beads of ultra-fine quality and remarkable sheen, skilled workmen introduce traces of an exceedingly fusible and volatilizable metallic alloy.

The glass employed is of a specific composition, specially manufactured for the purpose in the form of long tubes or rods.

Lanthanium and Bacteria

SALTS of lanthanium appear to have a special action upon microbe life such as is not observed with other rare earth metals. For instance, when a culture of the microbe *B. subtilis* is made on the surface of a liquid medium, it develops and forms a film which is quite characteristic. In a paper presented to the Société de Biologie, A. Frouin noticed that this property of film formation kept up when weak solutions of different salts of rare earths were added to the culture medium, except for salts of lanthanium. In this latter case, in a culture medium containing 1/1,000th part of sulphate of the metal, the microbe will develop in a homogeneous manner, but no longer produces the film such as is always formed under the usual conditions. On the other hand, after culture in a medium containing this metal, the microbes can be transferred to a normal medium and are now seen to develop as usual with formation of the characteristic film. This special action of a rare earth upon a microbe is remarkable, the more so as it does not appear to hold good with other aerobic species.

Battleship Drill Indoors

How New York Trains Her Naval Militia

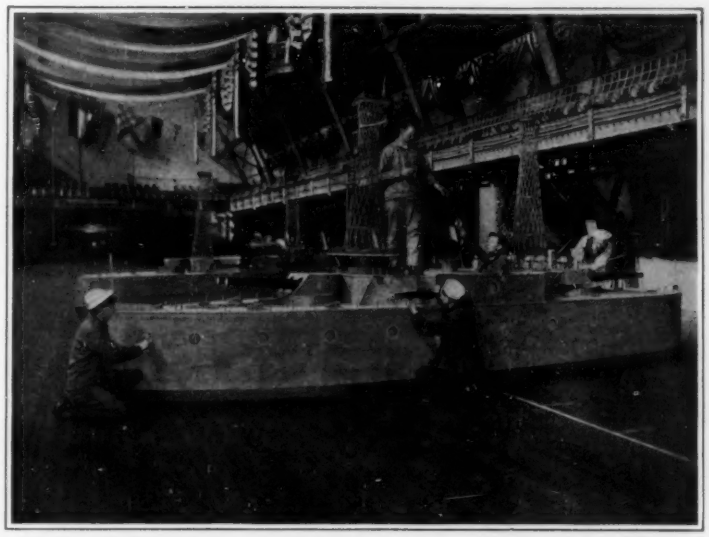
A NOVEL expedient has been adopted by the Second Battalion of the New York Naval Militia to train its officers and men in fleet evolutions and in the "Rules of the Road" at sea. Four miniature battleships have been so constructed that they can maneuver on the armory floor in the same way that a fleet does at sea. By cutting the hulls off at the water line and mounting them on wheels located inside the ship, a striking realistic effect is produced. The ships are steered by men seated so that their heads come under the forward fire control masts, but are concealed by the bridge and by weather cloths through which peep holes are cut. The motive power is supplied by two men under the super-structure working hand levers connected by gearing to the forward wheels. Tiller ropes run from the steering wheel to an axle aft which carries a loose wheel on either end and swings freely on a vertical shaft so that when the helm is put over, the stern swings to starboard or to port.

The ships are equipped with running lights, searchlight, truck lights and Ardois system, all connected to storage batteries, and with all lights extinguished in the armory, night practice can be carried out. The various conditions of ships meeting at sea, both by day and by night, can be exactly reproduced and the proper procedure explained in detail to a large class seated in the galleries. The evolutions of a division of ships are carried out by the same signals as at sea and the ships form column, line, echelon, turn and countermarch with the greatest facility, and afford invaluable practice preliminary to the annual summer cruises.

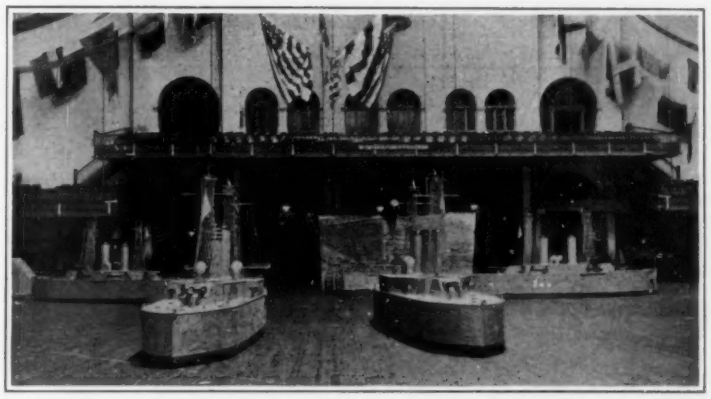
As the models are complete in their equipment, they are also useful in teaching recruits the nomenclature of a battleship.

Apart from its value as assisting in the instruction of the Naval Militia, the fleet has proved of great interest to the general public. At a recent review of the organization, about five thousand people for the first time saw how a fleet of battleships is maneuvered in cruising and battle formations and a very realistic exhibition was also given of a night blockade, one vessel lighting up a harbor entrance with its searchlight, while the others cruised around on circular blockade with all lights out or screened.

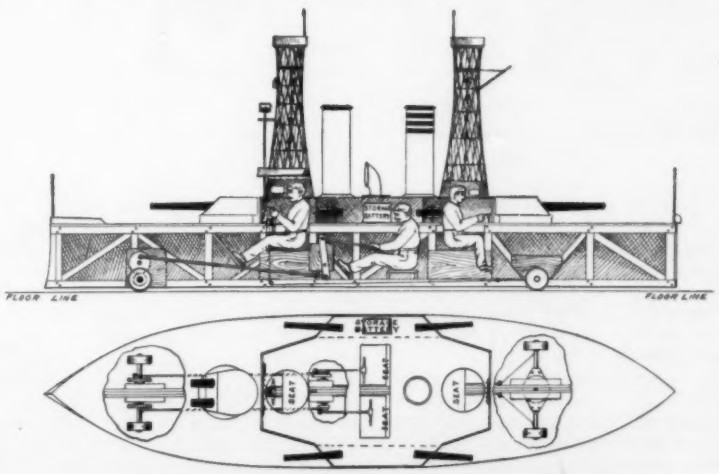
The ships were constructed under the direction of Commander Kingsley L. Martin by the Chief Gunner's Mate of the Battalion, William H. Free, and his assistants at the armory, foot of Fifty-second Street, Brooklyn, N. Y.



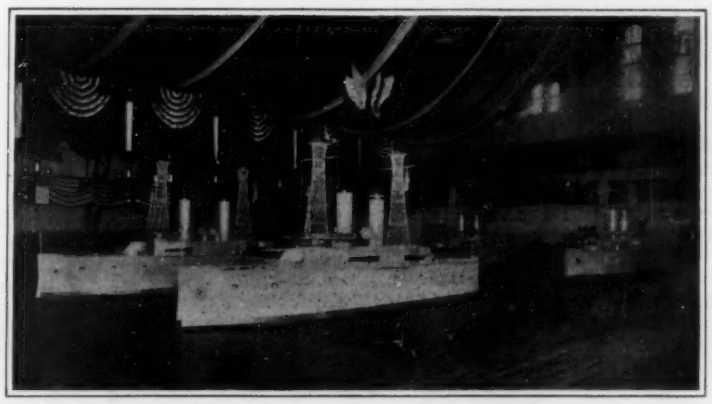
Completing a miniature battleship for maneuvering exhibitions.



The evolutions of a division of battleships are carried out the same as at sea.



Detail constructive plans of practice battleship for naval militiamen.



Forward movement of model battleships that can be made to turn and countermarch with greatest facility.

News of the Coming Road Congress

HOW to systematize the purchase of road equipment and materials will be explained in a paper to be read by Henry G. Shirley, chief engineer of the Maryland State Roads Commission, at the American Road Congress, which will be in session during the week of September 29th, at Detroit, Michigan. This paper deals with one of the many important subjects to be treated by experienced engineers, public officials and road contractors at the big meeting. The Maryland Commission has been working out the problems of good road administration in a most painstaking and thorough manner and Mr. Shirley's paper will undoubtedly present some interesting conclusions.

Col. E. A. Stevens, State Highway Commissioner of New Jersey, will have a paper at the Congress on the treatment which he has found most effective for worn out or raveled macadam surfaces. New Jersey was the first State to adopt the State aid plan for road construction and consequently has a large mileage of water bound macadam roads which are being adapted to new traffic conditions.

"The Merit System in Road Administration," will form the subject of an address by President John A. McIlhenny of the United States Civil Service Commission, and will undoubtedly attract nation-wide attention. Political favoritism, incompetence and indifference characterize the administration of our public roads so generally as to cause a loss estimated by some experts as high as $40,000,000 a year. Mr. McIlhenny's paper will show the demoralizing effect of political domination in road management and point the way to an efficient system which will mean skilled supervision, continuous and practical service and due economy.

Hardening Fats by Catalysis

IN many industries, such as the making of soap and stearin, and the manufacture of various edible fats, the firm hard fats are more prized than those which are soft, lardy, or oily. Hence a means of hardening the latter has long been sought.

After many failures success has been recently achieved, so that it is possible to change the soft and liquid fats or oils into hard fats with a correspondingly high melting point.

In principle this consists in the introduction of hydrogen into the fluid fatty acids contained in the soft fats and oils.

This depositing of hydrogen takes place, according to the *Technische Rundschau*, when the fats are warmed in the presence of the so-called *contact-bodies*. Nickel and palladium are especially valuable as such catalyzers, either in the pure pulverized state, or in the form of aqueous solution of various salts of these two metals.

The fat to be solidified is warmed with about one fifth per cent of the metal powder or the solution, the temperature varying between 100 deg. Cent. and 300 deg. Cent. for different fats and different processes. Then hydrogen is led in at the highest temperature required, and when necessary the reaction is hastened by increasing the pressure 2 to 3 atmospheres.

This process is long past the laboratory stage and has been applied in various industries on the large scale, and has been found economical as well as useful.

An advantageous feature is the destruction both of coloring matters and of malodorous substances in the fats treated, so that a long series of previously inevitable purification processes is avoided.

This method will doubtless soon cause a revolution in the industries involved, and will incidentally extend the market for hydrogen.

A Case of Latent Life

A REMARKABLE case of animal lethargy or latent life is found by M. Issel among the small crustaceans (*Harpacticus fulous*) of sea ponds. The water of these pools, which lie near the shore, undergoes great variations in amount of salt, being diluted after rain and concentrated in dry periods so much as to deposit salt on the bottom. During high tides, when the pools are filled with a fresh supply of sea water, the crustaceans are very active and cover long distances by swimming; but when the salt solution becomes concentrated, their movements are gradually slower, and finally they remain on the bottom apparently dead. But this is in fact only in appearance, for when he transported the inert animals to a less concentrated water as ordinary sea water, they revived in a few minutes and began to swim actively. M. Issel calls this unusual phenomenon *osmotic lethargy*, to distinguish it from the lethargy produced by desiccation or cold. As to how long such latent life would be maintained, he collected inert specimens and placed several of them in sea water each day to revive them, and found that after 17 days this was still possible.

The Reflector—The Telescope of the Future

Why the Large Refractor Must Give Way to Mirrors

By Edward Arthur Fath, Director of the Smith Observatory, Beloit, Wisconsin

THE rôle of prophet is by no means an easy one, and many a prophecy fails of fulfillment because of the introduction, at a later time, of previously unknown factors. In spite of this difficulty, however, I shall attempt, at the request of the Editor, to tell why I believe the reflecting telescope will be pre-eminently the telescope of the future.

In the beginning it may not be out of place to recall the essential difference between refractor and reflector. The former is the one usually called to mind when we think of a telescope. It has a lens at the upper end of a tube through which the light passes. At the lower end is the eyepiece through which we look. On the other hand, the reflector has no lens, but a large concave mirror which takes the place of the lens. This mirror is placed at the lower end of the tube, the latter being open at the upper end. The light passes down through the tube to the mirror, is reflected back to the upper end and brought to a focus where the eyepiece or photographic plate is placed.

There are four points to be considered in planning for a telescope: Original cost, maintenance, efficiency and adaptability to various classes of work. Let us compare the two types of telescope under these heads.

Original Cost.

Under this division we shall consider two telescopes of three feet aperture. The Clarks received $50,000 for the 36-inch lens of the Lick Observatory and a mounting similar to that would cost about an equal amount. Thus this large refractor may be considered to represent an investment of approximately $100,000.

Now compare this cost with that of a reflector of the same aperture. It is possible to obtain a 3-foot mirror for about $5,000. A suitable mounting can be had for about $15,000, or even less if a very simple design is chosen. A well-equipped reflector would therefore cost in the neighborhood of $20,000, or approximately one fifth that of a refractor of the same size.

For telescopes of this aperture, which must be permanently mounted and properly protected from the weather, an additional item must be considered, namely, the cost of building and dome. The reflector can be made much shorter than the refractor so that a dome with a diameter of 40 feet is ample for a 3-foot instrument of this type, while the great Lick refractor requires a dome having a diameter of 75 feet. Since the cost of domes varies approximately as the cube of the diameter, the refractor dome would cost over six times as much as a similar structure for an instrument of the other type.

It may therefore be said that, in general, the properly housed refractor of large size will cost at least five, and possibly six, times as much as a reflector of the same aperture. For smaller instruments the ratio may be even higher.

Maintenance.

Barring an occasional dusting of the front lens surface and possibly the work of washing it once or twice a year, the refractor requires little care. The reflector however needs occasional renewing of the silver film. The frequency with which this is necessary depends upon the location of the instrument and the care with which it is protected. If the writer has been correctly informed it is necessary for a certain large reflector to be resilvered about once a month. This is due to the large amount of smoke and combustion products in the atmosphere near its location. At the other extreme probably stands the Crossley reflector of the Lick Observatory. The silver film on the mirror with which Keeler obtained his famous photographs of the nebulæ, was over five years old. Under ordinary conditions we may say that resilvering about twice a year is all that is required for a telescope in regular use. The silvering process is by no means difficult and takes but a comparatively short time. Thus the 60-inch mirror at Mount Wilson can be taken from the telescope tube, resilvered, and again be put into position in a day. Smaller mirrors can be attended to in much less time.

Ordinary changes of temperature have but negligible effects on the performance of lenses, while mirrors are very susceptible to them. It is therefore necessary for the most refined work with large mirrors to have some arrangement for keeping them somewhere near the night temperature. A small refrigerating plant is used at the southern station of the Lick Observatory at Santiago, Chili, while an insulating cover of woolen blankets is provided for the 60-inch mirror on Mount Wilson.

Efficiency.

It is probable that from the standpoint of visual observation a good refractor will give somewhat better definition than a reflector of the same size. To the best of the writer's knowledge no really definite tests to determine the precise difference between the two types have ever been carried out, but the few trials actually made give the refractor the better of the argument. In theory there should be but little difference.

Visual observations, however, are by no means so important, relatively, as they were 25 years ago. At that time practically all observations were visual, but now I believe it is not far from the truth to say that fully three fourths of all modern astronomical observations are photographic. At the Mount Wilson Observatory not one per cent of the observations are visual.

There is no question whatever that the reflector is a far better photographic instrument than the refractor; for it brings all the rays of light of whatever color to the same focus, while the lens of the refractor does not.[1] It therefore seems only reasonable to use the instrument best adapted to modern conditions.

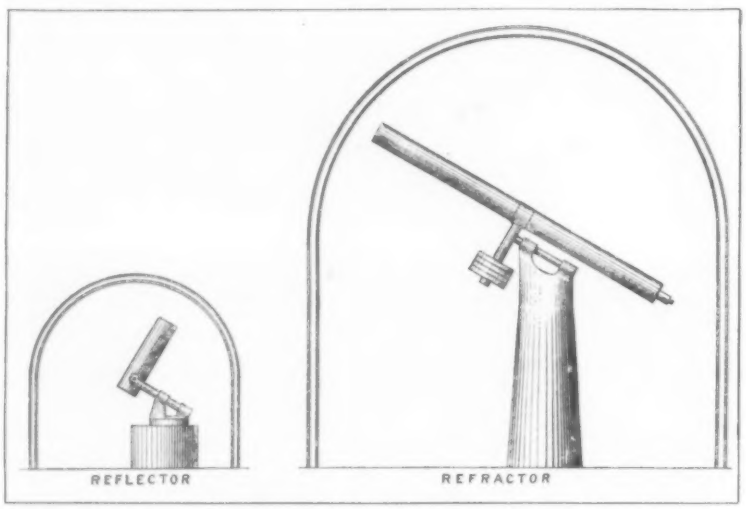


Diagram showing relative size of structures required to house two telescopes of the same aperture, but of different types.

This freedom of the reflector from spurious color effects is also of value in visual observations, particularly in the study of the colors of the stars and in work on the planets. It is so marked that a veteran observer, who has used the two largest refractors in the world and also the largest reflector in operation, recently told the writer that for work on the planets he would without hesitation choose the reflector.

There is another point, however, which must be considered under the heading of efficiency. Telescopes are ever increasing in size. In order to have a lens or mirror perform well it must be supported in such a way that the flexure due to its own weight does not injuriously deform the optical surface. A lens must be supported from the edge. There comes a time when an increase in size will add sufficient extra weight to produce appreciable deformation and thereby injure the performance of the telescope. Certain tests made with the 40-inch lens of the Yerkes Observatory lead to the conclusion that it would not be advisable to make a refractor of larger size unless a new way of supporting great lenses is found. With a mirror, however, it is possible to have the glass of sufficient thickness to be fairly rigid and then have a system of supports so designed as to support the entire back of the mirror and thus completely prevent flexure.

Furthermore, the larger a lens the thicker the glass. This means increased loss of light due to absorption. That this is really a serious matter will be realized when it is known that the great Lick and Yerkes lenses transmit only about 50 per cent of the photographic rays falling on them. This loss is due primarily to absorption. Doubling the size of such a lens would about double its thickness and it would therefore transmit only about 25 per cent of the actinic rays. This means that while the lens area has been increased four times the amount of light reaching the image would only be doubled. Now the silver film of a mirror in good condition reflects about 60 per cent of the photographic rays. Therefore by doubling the aperture of a mirror, the light reflected is increased in the same ratio as the area or four-fold. Accordingly for large instruments, the reflector is the more efficient in its light-grasp.

[1] This is termed the chromatic aberration of the lens.

Adaptability.

A refractor is not well adapted to most kinds of direct photographic work. It can, however, be used for both visual and spectrographic observations. On the other hand, the reflector is well adapted to visual work and is at its best in spectrographic and direct photographic applications. It is therefore the more universal instrument.

Thus far the point of view has been that of the working observatory. Let us now take the amateur into consideration. The average individual of this class is not blessed with a superabundance of this world's goods and he therefore usually buys the optical parts of a telescope and makes the mounting himself. Suppose such a person wants a telescope and must choose between refractor and reflector. What shall he do? If he will experiment a little until he is not afraid to do his own silvering the writer believes he will feel much better satisfied with a reflector of from 9 to 12 inches aperture than with a 4 or 6-inch refractor costing about the same amount. The larger reflector will show fainter objects as well as their true colors, and for surfaces such as nebulæ the image will be brighter for the same magnification.

However, the great consideration in this connection is the following. Very few people possess the necessary mathematical training and mechanical skill required to make refractors for themselves, but many can, with the exercise of sufficient care, make very creditable reflectors. Thus, by means of their own handiwork, they may penetrate into the depths of space and see for themselves the wonders of the heavens. There has been so much published in recent years on the making of reflecting telescopes that almost anyone, of average intelligence and sufficient patience, can achieve this result.

A friend of the writer's recently completed a very satisfactory reflector of 8 inches aperture. The total cost, including a simple mounting, was $6. The small flat had been given to him, but even if he had been obliged to buy it, the cost would have been but $10 more.

In the foregoing I have stated some of the more important reasons why I believe that, in general, the telescope of the future will be the reflector. These reasons may be summed up as follows: The first cost of the reflector is relatively low, and, while it requires a little more care than its more aristocratic brother, yet this is a small item as compared with its greater general utility.

The Compressed-air Transmission Reappears.—Despite the rebuffs to which the compressed-air transmission has been subjected, two Frenchmen, convinced of its value, have brought out a car in which air is made the medium through which the power of the engine is transmitted to the driving wheels. According to the system, the engine has four cylinders, set in a V, two of which act as pumps to compress the air in a tank hung to the chassis. From the tank, the air is admitted to two other working cylinders direct connected to the rear axle of the car. In operation, the system works on the same general principle as do hydraulic transmissions, with the important difference, of course, that the air is a great deal more elastic than is the oil in other systems; hence great claims are made for the air system. At present it is being tested out, and though its efficiency has not been demonstrated to be very high, it is expected that its simplicity and flexibility will overcome the disadvantage of its inefficiency. Enough air is stored to make the vehicle self starting.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Natural Toothbrushes

To the Editor of the SCIENTIFIC AMERICAN:

Apropos of the paragraph on "Natural Toothbrushes" in your issue of June 7th, it may be of interest to state that these are used by many of the people of our Southern States, chiefly in the rural districts. Twigs of the black gum are those most in favor, while strips of thick hickory bark are also used in the same manner. Users of snuff chew the end of the twig until it assumes a brush-like form, and then dip it into snuff. It is then rubbed on the gums and carried in the mouth. I have observed this frequently in Arkansas, and the practice no doubt prevails in other parts of the South.

Washington, D. C. PAUL R. BIRGE.

How the Public is Affected by Price Maintenance

To the Editor of the SCIENTIFIC AMERICAN:

Two years ago the manager of a chain of Southern stores said to us: "We can easily sell Hoosier cabinets to our trade for $10 more than the price you fix, and all we ask is that you keep your price list out of our territory. The Hoosier name is well known, and the cabinet is a much better cabinet than people can buy anywhere else for the same money, so why shouldn't we be allowed to make the extra profit we can get for it?"

When we refused to allow that dealer to fix his own price on Hoosier cabinets, he took up an unadvertised line of cabinets and is selling them for the exorbitant profit he wanted to make on the Hoosier.

Our policy has been to limit the price of Hoosier cabinets to a small, fair profit, and to require our agents to stick to that strictly. As a result, Hoosier agents know that they can rely upon this small profit on every cabinet, and they push the cabinets with confidence and success. They have made more profit on these cabinets than on a great many other lines of furniture on which the price fluctuates. The result has been an increase in volume of sales, which has lowered our cost of production and enabled us to put constantly more value into the cabinet. We have had a constant fight to keep dealers from pirating the good will our national advertising has built up, by getting hold of one or two Hoosier cabinets and offering them at a cut price, and then switching the prospect to some other make of cabinet on which there was a long profit.

Under the previous interpretation of the law we were able to stop this practice by limiting the sale of Hoosier cabinets to exclusive agencies and strictly regulating the price at which the cabinet could be sold. With this restriction taken away, there is now nothing to prevent a dealer from offering Hoosier cabinets at a ridiculous price in order to draw trade from his competitor. He will not sell many cabinets at this price, but he will make it impossible for the competitor to push Hoosier cabinets at the legitimate price, and the tendency will be to throw kitchen cabinets into the class of "disorganized merchandise" that has been responsible for the chaotic condition of general furniture business in the past.

THE HOOSIER MANUFACTURING COMPANY,
New Castle, Ind. E. G. MCQUINN, Sales Manager.

Price Protection and the Consumer

To the Editor of the SCIENTIFIC AMERICAN:

Price maintenance is a highly important question and one that will have to do very largely with the economical purchasing power of a dollar in the near future.

We do not believe in a monopoly or in agreements regarding the fixing of prices by competitive manufacturers, but we do believe that the consumer is more thoroughly protected when he purchases an article upon which the manufacturer has fixed a selling price than he is in the purchasing of an article that has not been standardized in this manner.

Our reason for making this statement is: First. Because the manufacturer cannot afford to establish a price that is too high or exorbitant for his product, therefore he must give value received. Second. If he is assured that the article which he is manufacturing is to be retailed at a certain price, he is enabled to plan his product and distribution in the most economical manner, thereby giving the consumer full value for money expended. Third. Retailers generally prefer to handle standard priced articles, and they will tell you almost without exception that while they do not make as large a profit on these goods as they do, as a rule, on goods which are not standardized, on account of the universally better satisfaction given to their customers they find them more profitable to handle.

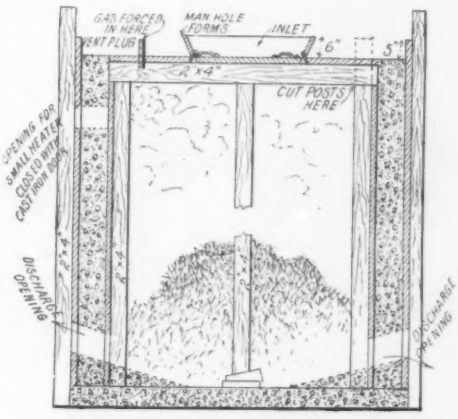
Personally, I much prefer to go into a store and buy an article which is sold at an established price to everyone. As a manufacturer I feel that we would be unable to maintain the high quality of our product were it not for the fact that we insist on prices being maintained at a certain standard. SOUTH BEND WATCH COMPANY,
South Bend, Ind. S. D. RIDER, Vice-President.

Practical Elimination of the House Fly

To the Editor of the SCIENTIFIC AMERICAN:

The case against the house fly has been so thoroughly and well handled that no further argument as to the desirability of eliminating this pest is necessary. The criminal has been condemned to death. These undesirables, however, are so numerous as compared with the executioners that no impression can be made by this means of procedure. A great deal has been written on the subject, well meaning idealists have expounded their theories for years on the lecture platform, but so far the writer has been unable to find even the suggestion of any practical method which will tend to diminish this pest. Therefore, let us get at the cause and see if it is not possible to destroy this insect before she can lay her eggs.

Every student of the subject knows full and thoroughly well that the house fly is hatched in stable manure; one fly will lay 150 eggs a day, the progeny of one fly during a season could multiply to the enormous figure of one hundred and ninety-five billion. If we attempt to destroy the larvæ, or the eggs, by means of acids or lime, we also destroy one of the most valuable



Concrete manure pit designed to facilitate the killing of flies.

products of the farm. Lime will release the ammonia in the manure and thus destroy to a great extent its fertilizing value. The same occurs when various acids are applied. So our problem is to preserve the fertilizing value of the manure and at the same time destroy the fly before she has an opportunity to lay her eggs.

As the eggs hatch, the larvæ work upward. They never work downward. The habit of this insect can be well noted by observing any fly trap. The bottom of the trap is always open. As the fly's instinct is to work upward, it never finds the opening.

Some philosopher has said that a problem once well and thoroughly stated is half solved. I have briefly stated the problem, and keeping in mind the instincts of the insect, a solution for the elimination of the fly presents itself, and in presenting itself we also find a means of better preserving the fertilizing value of the manure.

Up to the present time, this value has been conserved by the use of concrete manure pits, thus retaining the liquids and therefore the nitrogen. Carry this idea a step farther and build a concrete tank with a covered top. The tank should be circular, and a manhole should be placed in the top of the tank, a venthole consisting of ½-inch or ¾-inch pipe with screw cap also placed through the top, or a trap door in the side at the top, and two or more discharge openings at the bottom. The cover is removed from the manhole and the manure placed in the tank. The cover is immediately replaced over the manhole, and before the next batch is placed in the tank, a gas or vapor which will kill the fly is forced in through the vent pipe at the top. There are many gases which will accomplish this result, for instance, sulphur or carbolic acid fumes produced by means of a small furnace placed back of the trap door, in the side of the tank, near the top.

By this method, between the time each batch is placed, the flies that are hatched, are killed. The larvæ hatch in a few hours, always work upward, and become pupæ in about five days. The discharge opening being at the bottom does not form an outlet for the fly, the liquids are all retained and the manure can easily be removed by long handled rakes or hoes, or if the tank is sufficiently large, a chain conveyor can be operated running across the bottom of the tank, pulling out the contents, which of course by gravity is automatically replaced.

A circular tank 15 feet in diameter and 10 feet high will hold about 60 tons of manure. Such a tank placed alongside the stable, at a level lower than the stable floor, serves the double purpose of conserving the fertilizing value of the manure and killing the fly before she can lay an egg. The size of the tank depends on the number of head of stock. On a large stock farm, such a tank of above dimensions would cost about $80 and would more than pay for itself in one year.

New York city. ALBERT MOYER.

How the Retailer and the Public Benefit by Price Maintenance

To the Editor of the SCIENTIFIC AMERICAN:

As a manufacturer who believes that his duty lies in serving the public, I wish to express my appreciation and approval of the stand which you have taken in regard to the right of the manufacturer to establish the price at which his product shall be sold to the consumer.

The popular conception of this matter, as held by the general public, is so erroneous and so inimical to their best interests, that I cannot conceive of any work which can be of more importance and of more service to the public as a whole than that of presenting clearly and concisely the true facts of the matter.

The main object of all manufacturers is to place a price on their product which will enable the largest possible number of people to buy and use it and at the same time yield to themselves and to those who distribute their product an adequate and reasonable profit.

As volume of business is the thing most desired by the manufacturer, and as he realizes that the volume must depend absolutely on the reasonableness of his price, the possibility of his setting a price which will be unreasonably high or yield himself or his dealers an exorbitant profit is extremely small.

As a matter of fact, out of the several hundred trademarked articles on which an effort has been made to maintain the price by the manufacturer, I know of no instance in which the price has not been lower than it would have been if the establishing of the retail price had been left to the unrestrained action of the retailer.

The main object of the retailer is to secure volume and profit, just as these are the main objects of the manufacturer, but the retail dealer's ideas of the proper way to secure volume and profit are very different from those of the manufacturer.

The average retailer believes in securing an abnormally large profit on the greater part of the merchandise which he sells, and trusts to securing his volume by offering an abnormally low price from time to time on certain articles, which he believes will bring the people to his place of business.

It seems to me that it is eminently unfair that certain people have to pay a very excessive margin to obtain certain merchandise that other people are able to obtain at practically cost as a result of this merchandising system.

With the right to establish re-sale prices once granted to the manufacturer, the abnormally high price and the abnormally low price are both eliminated from the scheme of retail distribution.

The retailer, instead of securing 40 per cent, 50 per cent or 60 per cent gross on his retail price, as it is his desire to do on the majority of goods which he sells, must content himself with the normal 25 per cent or 33⅓ per cent which the prices established by the manufacturer yield him.

Neither is it possible for him to cut the price on this product to a point where there is no profit in it for him, where he undermines the business of his competitor simply for the purpose of getting people into his store with the ridiculously low-priced article as a bait in order that they may purchase increased quantities of the exorbitantly priced articles.

The educational work which you are doing will, I think, help to prove to the public that the greatest element in the high cost of living to-day is the excessive cost and profit of retail distribution caused by too fierce competition on the part of the retailer and a desire for too heavy a profit on his part, and that the only curb to this excessive cost of distribution lies in giving the manufacturer the right to establish a reasonable price at which his product shall be sold.

NATIONAL VENEER PRODUCTS COMPANY,
CHARLES R. STEVENSON, General Manager.
Mishawaka, Ind.

Carrier Pigeons in the French Army

By Lucien Fournier

Carrier pigeon with dispatch in its tail.

The dispatch tube is slipped over the tail feather.

A pair of French military carrier pigeons.

IT might be imagined that the present era of the aeroplane and the wireless telegraph has no use for the swift and faithful winged messengers which rendered such valuable service in the Franco-German and other wars. Many persons, indeed, are convinced that carrier pigeons now serve only for the amusement of a few old fogy sportsmen.

These views are quite erroneous. The attention devoted to carrier pigeons by the governments of Europe, and especially by that of France, show that the services rendered by these birds to besieged Paris have not been forgotten, and that at least as great a reliance is yet placed upon them as upon the mysterious and erratic Hertzian waves.

At present France maintains twenty-eight military pigeon houses, distributed among the fortifications, especially along the eastern frontier. These establishments, which are in charge of the engineer corps, are devoted to breeding and training carrier pigeons.

I have succeeded in obtaining special permission to visit the military pigeon houses of Vaugirard, near the fortifications of Paris, where the system of breeding and training was explained to me by the commanding officer. The reader will be surprised to learn how much care is lavished upon the birds. The soldiers love the pretty little creatures, and follow their educational progress with keen interest.

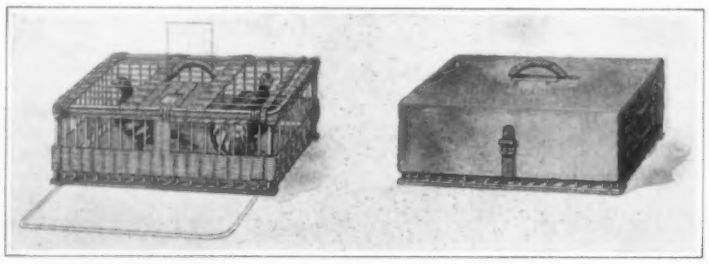
At Vaugirard, as elsewhere, the pigeon houses are placed on the roof of a building, and each is divided into two compartments by an alley. The floor is composed of plaster, covered with a layer of dry and moderately fine sand, which protects the feet of the birds from fecal defilement. The water vessels are made small in order to minimize the quantity of water which the birds scatter in bathing, but whenever it is possible to have a supply of running water on the roof of the pigeon house commodious basins are there installed, in which the birds can bathe freely and thus rid themselves of vermin.

In all cases abundant ventilation is provided, about 35 cubic feet of space being usually allotted to each pair of adult pigeons and 9 cubic feet to each young bird. In order to facilitate the circulation of air, the roof of the pigeon house is never plastered, except in mountainous or other cold regions.

The orientation of the house is a matter of importance. Nearly all of the French pigeon houses face approximately north-northeast, or in a direction opposite to most rainstorms. The administration takes care not to place pigeon houses near telegraph or telephone lines, which might injure birds, striking them in flight. Large trees and high buildings are also objectionable because they afford convenient perches for pigeons willing to shirk their flying exercises. The cages are inclosed in glass sashes in order to keep out rodents, and neighboring chimneys are covered with wire netting to prevent young pigeons from falling into them. All of the military pigeon houses are connected by telephone with the offices of the engineer corps.

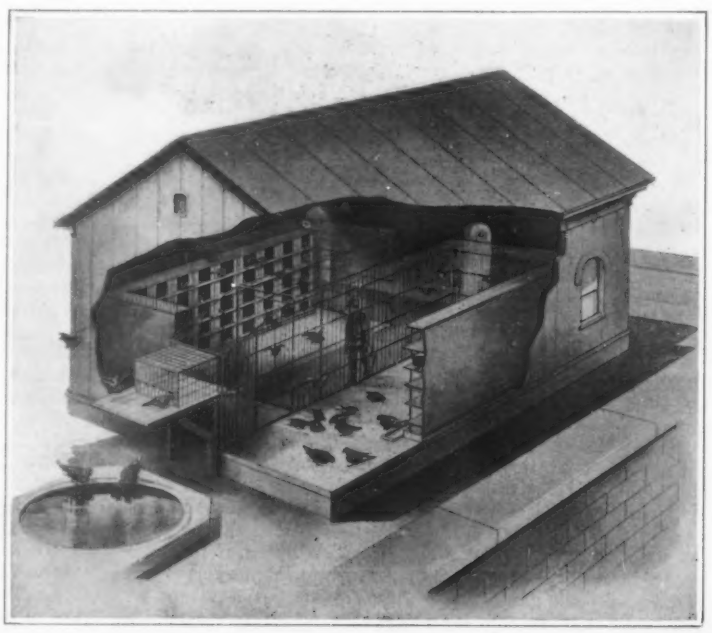
As a rule, each pigeon house contains 100 pigeons ready for mobilization. To maintain this effective force requires one or two compartments of 130 adult pigeons, a compartment of 200 young birds of the year, two detention pens (one for each sex), which are used only at a certain season, an infirmary facing the south, and a laboratory for the reproduction of dispatches.

The denizens of a pigeon house are selected from birds four or five weeks old, which have not hitherto left their natal house. They are first subjected to four or five days' observation in order to ascertain that they



The basket in which the pigeons are carried.

are sound and to supervise their feeding. They are then encouraged to emerge from the house and fly about by allowing them to escape voluntarily, without frightening them, so that they will recognize the entrance door. This is done about 3 P. M. daily. If the birds were driven out they would probably fly far and fail to return. When adult birds are added to the colony the preliminary training must be greatly prolonged. The newcomers must first be penned up for a considerable time, then mated with older residents, and finally prevented from flying during the entire season by shortening five or six principal feathers of the left wing by about two inches. At the moulting season the amputated feathers are replaced by whole ones. By this time the birds have become accustomed to their new home. The effective or mobile corps, which in May consists of 100 pigeons from 2 to 8 years old, is increased in October by the addition of 6 reserve birds and 23 young birds, 18 months old, which have taken part in two training campaigns. The winter colony, usually reduced to 130 birds by inevitable losses, produces 200 young for the next season's training.



Type of dovecote used by the French Army for the sanitary housing of its carrier pigeons.

The pigeons are fed on mixed beans, peas and vetches, which have been gathered a year. The individual daily ration consists of about 1½ ounces of this mixture, divided into three meals, given at dawn, noon and 3 P. M. The pigeons are also provided with clay, old mortar, fine river sand, salt and egg shells or oyster shells, ground and mixed in equal parts. This mixture, which is called "salted earth," is left permanently in the cages.

In pairing, care must be taken not to mate two birds of very light coloring, or of very close kinship or strong resemblance. Pigeons differing in color of plumage or eyes should be mated, and crosses should be made between large and small, old and young, shy and tame birds. After marital concord has been established by a few days of enforced cohabitation in seclusion, the couple is allowed the liberty of the compartment. Two eggs are laid within a fortnight after mating and are hatched 17 days later. When the young pigeons are three or four weeks old and have begun to feed themselves they are separated from their parents and placed in a compartment which has a southern exposure and receives the maximum amount of sunlight. The young birds of the second or autumn brood are not usually preserved, because they are less robust and moult abnormally. The military training of carrier pigeons begins with exercises in flying about the pigeon house. Every bird is required to fly, during an hour at least, twice daily. These trial flights are supervised with great care. When the cages have been opened, the soldiers drive out the pigeons and prevent them from perching on the roof of the pigeon house. The few birds which set a dangerous example to their fellows by alighting on neighboring roofs are shot without compunction. Well-trained pigeons have a range of flight which occasionally carries them out of sight. Young birds begin with flights of a few minutes' duration, which is gradually increased to one hour at the age of three months. In order to make the birds understand what is required of them, the same signals are always given for the same evolutions. The pigeons are induced to leave the cages by shouts, clapping of hands and striking the partitions of the compartments, and they are recalled by whistling, after the mangers have been filled and grain has been strewn on the floor.

The flying exercises are followed by training in carrying dispatches over progressively increased distances. In case of mobilization the pigeons would be transferred to some place which must be kept in communication with the army, in the event of invasion. It would seem

logical to carry on the training in connection with this place, where the birds are liable to be confined during several months, when all other means of communication have been destroyed. This procedure, however, is not deemed to be quite regular, and as a rule the practice flights take place in every direction around the pigeon house.

The flights are not attempted in rain, snow or fog. Hence the winter months are deemed unfavorable, while February, March and April are devoted to the foundation and care of the young birds. The training of carriers, therefore, is restricted to the period between April and November.

The pigeons are divided into classes, according to age. Those of the first class, or the corps of mobilization, from 18 months to 8 years old, make daily flights to their place of confinement. They are released singly or in small groups, sometimes all at once, but a rotation of individual flights is carefully observed, in order to subject each bird in turn to this method of training. Some of the pigeons are confined for a long time at the place of mobilization, and even a regular daily service over a given route is maintained for a definite period.

The length of the course is increased from 20 kilometers (12½ miles) on the first day to 30 kilometers on the third day, 50 on the sixth, 80 on the fourteenth, 130 on the twentieth, 210 on the twenty-seventh, and 300 on the thirty-fourth.

The yearling pigeons undergo nearly the same training, during six weeks. After a few preliminary releases in the vicinity of the pigeon house, the young birds attempt a flight of 10 kilometers, and the distance is gradually increased until it attains 200 kilometers at the end of the six weeks.

Practice flights are made over sea, as well as over land, when the location of the pigeon house permits.

The birds are released early in the morning in order to avoid the heat of the day. In calm weather the normal speed of flight is 800 to 900 meters (about ½ mile) per minute, so that it is easy to calculate the time required to return to the pigeon house.

The results of these practice flights are carefully recorded, together with losses of birds and other incidents.

As the purpose of these exercises is to train the pigeons for regular messenger service, the birds carry dispatches prepared specially for safe and easy transportation. The dispatches are either written or photographed. The former are written on sheets of very thin paper, measuring about 3 by 4½ inches, which are triply folded and then rolled up, so that they form slender rolls about 1½ inches long, which taper slightly toward one end.

The photographed dispatches are made from manuscript sheets measuring 11 by 14 inches, photographed on films measuring 1½ by 2 inches, which are simply rolled for transportation by the pigeons. On receipt, the film is applied to a plate of glass and read with a magnifying glass or projected on a screen by a lantern.

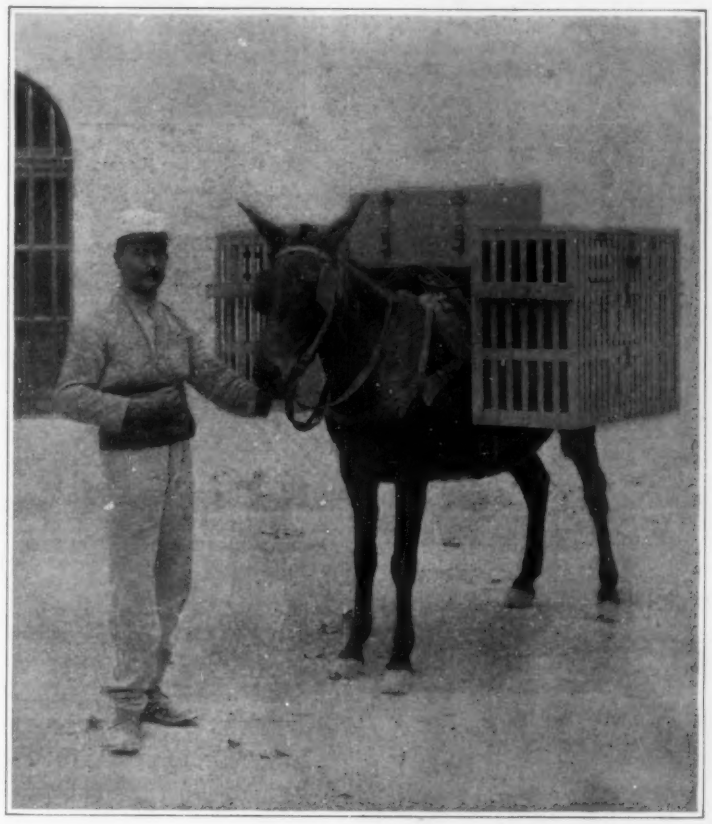
The practice dispatch contains a request that the capture of the pigeon be reported to the military authorities, and also bears the designation of the bird's home, the place, date and hour of release, the number of birds set free, a serial number and some meteorological notes.

The dispatches are carried in tubes of two sorts. One is a goose quill, 1½ inches long and 1/5 inch in diameter. The dispatcher seizes the pigeon with his left hand and presses its breast to his own. Then he separates one of the median tail feathers and passes it through the goose quill by compressing the barbs of the feather, which, when released, resume their normal position. The dispatch is then introduced into the void which the shank of the feather leaves in the goose quill, and is secured with a pointed match-stick. In another method, a tube of aluminium is attached to a leg of the bird, and the dispatch, inclosed in a smaller tube, is then inserted.

Every army carrier pigeon bears certain marks by which it can easily be recognized. The left leg is girdled by an aluminium band bearing the date of the year, the designation of the pigeon house and a serial number. These marks are also stamped on the right wing, together with the letter M or F, indicating the sex of the bird. Both the sex and the place of mobilization are revealed, furthermore, by a spiral band of colored celluloid borne on the right leg. A male is indicated by 2½, a female by 1½ spires or turns. There are seven colors: black, white, blue, red, yellow, green and violet, each of which corresponds to a different direction.

In order to complete this brief sketch it is necessary to mention the material equipment employed in breeding and training the carrier pigeons of the French army. This includes the equipment for the transportation of pigeons, in addition to the equipment of the pigeon house.

As the pigeons are allowed to leave the house at fixed hours only, it is necessary to place, at the entrance of each compartment, special entrance cages, which are set in the windows. These cages are so constructed



A mule laden with carrier pigeons.

Cart for transporting carrier pigeons.

that the birds can enter freely but cannot escape. The cage is usually 28 inches high, 32 inches long and 28 inches deep. The sides are formed of iron wires about 1½ inches apart, and the top is covered with a wire grating, having meshes measuring 4 by 5 inches, an interval sufficient for entrance, but too small for exit. The upper half of the front is like the sides, but the lower half is closed by a movable frame of inverted U-shaped wires, which swing on hinges from the top bar of the frame, the bottom bar of which allows the lower ends of the wires to move inward, but not outward. The returning pigeons, alighting on the board in front of the cage, enter by pushing these swinging wires inward, but cannot escape by the same way. The movable frame is raised by a cord to release the pigeons. The alighting board is made long and conspicuous in order to assist young birds in finding their way home. The breeding nests are arranged in superposed cells, each of which contains two nests, for the second clutch of eggs is often laid in less than three weeks after the first brood is hatched, and before the young birds are able to feed themselves. The top of the group of cells forms a promenade for the pigeons. The cells are closed, in front, by light wooden gratings, which are easily removed when the nests are cleaned.

The drinking fountains are of the familiar siphon type, and are composed of three-gallon bottles, supported in an inverted position on iron tripods over shallow troughs, into which their mouths dip. The house equipment comprises various appliances, which would interest none except pigeon fanciers.

The pigeons are conveyed from place to place in flat wicker cages. The birds are released for flight by opening a small trap door in the top of the cage. These cages are made in three sizes, which accommodate 25 to 30, 12 to 15, and 4 to 6 pigeons, respectively. The smallest, or training cages, are covered with muslin. The cages are transported by railway, in wagons or on mule-back.

The French military authorities encourage the breeding of carrier pigeons as far as possible. French civilians maintain numerous pigeon houses, which are under the supervision of the war ministry, and in which thousands of carrier pigeons are trained. The inhabitants of the *département du Nord*, like their Belgian neighbors, are enthusiastic breeders of carrier pigeons. The training begins with the advent of warm weather, and almost daily hundreds and thousands of pigeons are sent out, at first to neighboring departments, but later to the center and south of France, where they are released. The official military recognition of the carrier pigeon dates from the Franco-German war of 1870-1871. Although the birds then employed were poorly trained, they accomplished such remarkable feats that their aid in future wars is relied on with confidence. It is probable that pigeons will soon be carried by aeroplanes, despite the instinctive reluctance of aviators, who regard the birds as dangerous passengers. The rigging of a swiftly moving aeroplane might, indeed, be seriously injured by the impact of a pigeon, and the fouling of the propeller by a bird might be still more disastrous. For the purpose of averting these accidents at the moment of release it has been proposed to drop the pigeon, head downward, through a long vertical tube, so that the aeroplane would be far away before the surprised bird could right itself and begin its flight. This device will be tested by experiment during the coming season.

Coffee from Dried Figs

EVER since coffee has been a popular beverage, apparently, efforts have been made to find substitutes for it, either as mere adulterants, like chicory, or for the sake of greater wholesomeness or cheapness. Rye and other grains, lupine, acorns, beets and carrots have all been thus used, but the fig coffee, or *Feigen-Kaffee*, which has latterly come into use in Austria and elsewhere, is a decided novelty. *Les Annales* quotes M. Trabut of Algiers as saying that an excellent coffee can be made from dried and roasted figs, which need not be of the first quality.

They are dried in the sun or in evaporating pans, according to climate, and then roasted in ovens till brown or almost black and quite brittle. They are then ground up and the resultant powder is pressed into tablets. These must be kept dry. When made use of they are merely dissolved in hot water.

One hundred kilos of the dry figs give 75 kilos of the dry powder. The figs cost 15 francs and the powder sells for 60 francs wholesale and 100 or more at retail, so that the trade ought to be profitable if a demand can be created. The beverage is said to be agreeable in color and flavor with a somewhat sweeter taste than that made from chicory.

A Soft Laboratory Wax

A FAMOUS laboratory wax used as a filler or for attaching light articles to glass, etc., is made as follows: Beeswax, 40 parts; Venetian turpentine, 10 parts; rosin, 1 part; color with vermilion. Melt the wax and rosin, add turpentine and color. Stir until cold

Curious Resemblances in Nature

By Harold Bastin

TO trace in natural objects a resemblance, either structural or pictorial, to other objects with which they have no real connection is a diverting pastime. Moreover, though at first thought it may seem somewhat puerile, it can in fact be turned to good account as a means of stimulating the imagination, and inducing the mind to embark upon a course of truly scientific investigation which may lead to important discoveries. This applies in particular to the training of the youthful student. All those who have gained experience as teachers will readily admit the initial difficulty which exists in arousing the intelligent interest of a class in the subject of study. In other words, something is needed to set the machinery of the mind in motion. For example, a flower or an insect, as such, may fail to evoke the desired response. But if we can point out some curious or grotesque likeness which it bears to a familiar creature or thing, we are able from this starting point to lead on by carefully planned stages to such great questions as structure, natural affinity, and adaptation to environment.

Take, for instance, the case of the orchids. Several species bear popular names which suggest the likeness of the flower to some member of the animal kingdom. Thus, we have the man orchid, the bee orchid, the spider orchid, the lizard orchid, and the monkey orchid. It is true that some of these supposed likenesses are highly imaginative, but others are wonderfully distinct, and will bear close scrutiny. The bee orchid (*Ophrys apifera*), for instance, is very much like a small, highly colored humble-bee, the wings, head, antennæ, and hairy body being all reproduced. In the case of the so-called man orchid (*Aceras anthropophora*) the general effect of the flower is very quaint and striking, looking like a series of small green puppets. In the very curious fly orchids (*Ophrys muciféra*) the likeness to an insect is not very marked, although a vivid imagination can conjure up wings, antennæ and a protruding head; but the lower part of the flower resembles most closely a little doll, or monkey, dressed in a sleeping suit with a white sash round its waist.

In all these instances the resemblance is mainly due to the shape of the lip or labellum of the bloom. Now orchids rank admittedly among the most highly specialized flowers, while their extraordinary modifications are the result, largely if not entirely, of insect interference. Many of these flowers depend entirely upon the visits of insects for pollination, and without the aid of these winged emissaries of Cupid they are quite unable to set seed. The labellum is the recognized alighting platform upon which the insect stands while it probes the recesses of the flower in search of nectar; and as orchids are so closely associated with insects, we must assume that the special shape of the labellum in each instance is more or less definitely related to the convenience of the guests that are specially catered for by the flower in question. In certain instances this is actually known to be the case. Throughout the great orchid family the labellum exhibits an almost endless variety of configuration, and we are justified in the assumption that each form is exactly adapted to attract, or to uphold, a particular kind of insect.

Most young people are familiar with the canary-bird flower or the common canary creeper (*Tropæolum canariense*), and here again we find that the unusual form of the blossom is due to insect visits. The blooms of this group of plants seem specially designed to meet the needs of long-tongued moths, which seldom or never settle on the flower, but hover in front of it, lightly poised on their rapidly-moving wings. While in this position the tongue is unrolled and thrust far back into the "spur" of the flower where the nectar is stored. Meanwhile, the head or body of the moth comes into contact with the pistil or stamens, and pollen is deposited or removed, as the case may be. The flowers of Tropæolum are among the few in which nectar is secreted by the calyx, which is brightly colored and extended to form a long spur. The lower narrowed part is the nectary, and the sweet liquid is sometimes so abundant that it wells up to the moth. This spur, of course, forms the head and neck of the little canary bird, while the flamboyant tail is represented by two of the petals. When still a bud, the flower also presents a subdued, bird-like aspect.

An interesting resemblance to a swan is presented by the unopened flower-buds of the huge tropical birthwort *Aristolochia gigas*. This and allied species may often be seen growing in hothouses, and may be compared with the species of temperate regions, such as *Aristolochia tomentosa*, and *A. sipho*—the well known "Dutchman's pipe." All these very remarkable flowers, which rival the orchids in the grotesqueness of their form, are designed to attract and imprison small Dipterous (two-winged) flies which feed by preference upon filth and carrion—hence their foul smells and lurid colors which seem to suggest putrescence. The structure of the flower varies in different species, but the essential points are (1) an alluring area leading to (2) a throat or vestibule which, in its turn, conducts to (3) an inner chamber or prison. The swan-likeness of the flower-bud in *A. gigas* enables us readily to appreciate this description. The body of the "swan" eventually expands to form the alluring area—an enormous expanse, twenty-six inches long by eleven inches broad, the whole surface of which is covered with a network of blood-purple veins. These converge about the entrance to the mouth or vestibule (i. e., the neck of the "swan"), which is lined with inward-pointing hairs. Flies which settle upon the alluring area are induced by the strong scent of the blossom to enter the vestibule, which freely admits, and even facilitates, their entrance. But if they attempt to return, they are prevented by the hairs. Thus they are forced to penetrate the inner chamber of the flower

(Concluded on page 40.)

Buds of the huge tropical birthwort (*Aristolochia*) resemble swans in outline if viewed from one direction.

The "old man's face" exhibited by the staminal column of *Araujia grandiflora*.

Flower and bud of canary creeper (*Tropæolum*) the whole much like a fan-tail pigeon in appearance.

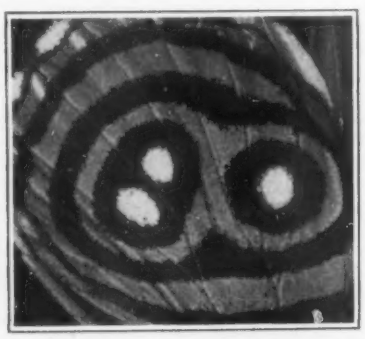
A "drooping bud" displayed on the fore-wing of a tropical "moon" moth.

Not a collection of human skulls. Seed-capsules of the garden snap-dragon.

The skull on the thorax of the "death's head" moth.

Flower of the sweet sedge (*Acorus calamus*) resembles a round file.

The wing tip of the Indian "snake" moth suggests the head of a cobra or a seal in profile.



The "80" mark on the hind-wing of a *Catagramma* butterfly.

A Clock That Speaks the Time of Day

By W. R. I.

THE look of surprise on the face of one's guest when an innocent looking phonograph sings out "Three o'clock" followed by a bugle call, amply repays one for making the inexpensive attachments. The following as made for the writer's Edison home phonograph will serve as a scheme for other models.

Two electro-magnets are necessary—one for starting and one for stopping. These are mounted as shown in Fig. 1. *A* is a stirrup of metal for mounting the two electro-magnets *B* and *C*. *D* is a block of metal ⅝-inch square fastened to the wire *E*, which is arranged to

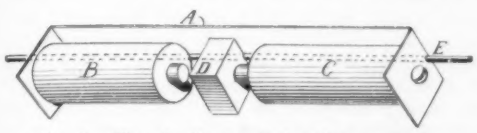


Fig. 1.—The starting and stopping magnets.

play easily back and forth through the holes in the stirrup. Small pieces of felt are set into small holes in the block *D* to prevent it from sticking to the magnets. The stirrup *A* is fastened by screws to the under surface of the phonograph top. The wire *E E* is left long enough to extend to the start-and-stop lever of the phonograph, if this lever can be so adjusted as to operate easily, otherwise the wire may be made to pass through a small hole *G*, Fig. 2, drilled through the governor bracket, and so adjusted as to catch on an extension *H* of a small brass clip *I* slipped over the end of the governor shaft. The clip *I* is made of spring brass with adjustable friction fit so that when magnet *B* is energized and the wire *E E* passes in the path of the clip the governor comes to rest gradually.

The "let-off" mechanism, Fig. 3, is attached to the

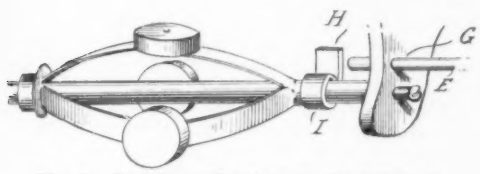


Fig. 2.—Starting rod acting on the governor.

back of an alarm clock by means of a bracket *J*. At *K*, Fig. 3, is light clock spring with weight *L*. *M M* are fiber washers insulating the screw contact post *N* from the bracket extension *O*. *P P* are brass pins set in the milled nut used to set the hands. These strike a plate on the spring *K*, raising the latter, and the plate, when released, makes momentary electrical connection between wires *R* and *S* operating magnet *C*. The "stop mechanism" is made in the same way as the "let-off." It is fastened by means of a suitable bracket beneath the flat spring that carries the "feed nut" and moves along with the reproducer arm as the record is being played.

Electrical contact is made when the small plate *Q* rides up on a tooth of the rack *T* and drops off. Platinum contact points were found necessary for the stop mechanism, as the adjustment had to be made more delicate than was necessary for the "let-off" attached to the clock.

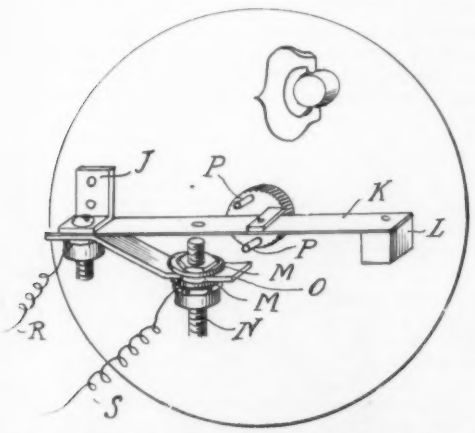


Fig. 3.—Let-off mechanism on the back of the clock.

The rack *T* is made of sheet brass and is fastened to the bed plate of the phonograph in any suitable manner. (One edge may be slipped under the name plate.) The points of the teeth *U U* are marked off to correspond with the "silent intervals" in the record.

A friendly cornettist will help you make a suitable record. (Explicit directions for making records may be had from any phonograph dealer.) Records are easily made, and the tunes on this style of phonograph clock may be varied to suit the fancy of its owner.

If arranged to speak the time every half hour (two pins *P P*, Fig. 3, being necessary) two records should be made, one from 12 to 6 and from 6 to 12, or one record speaking the hour intervals from 6 A. M. to 6 P. M.

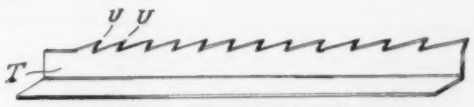


Fig. 4.—The contact rack.

Short silent intervals are necessary in order to allow the phonograph to reach full speed before speaking after the "let-off" operates. (The clock and the two dry cells necessary to operate may be placed inside the record cabinet.) When wishing to play records simply remove the rack *T*. By substituting a piece with one tooth near the end the phonograph stops automatically at the end of each record.

A Mercury Interruptor

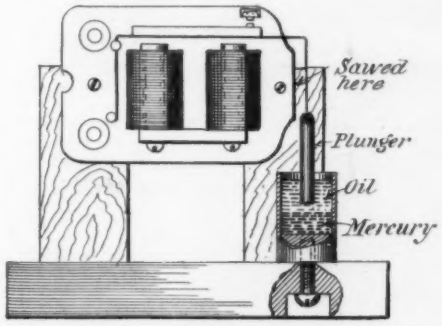
By George F. Worts

IN SO FAR as theory is concerned, interrupting the current for a spark coil for wireless use is a simple matter. In actual practice, however, contingencies arise and interruptors occasionally manifest contrary tendencies which cause their application in wireless telegraphy to be a source of no little annoyance.

For instance, the text books tell us that in an electrolytic interruptor small non-conducting bubbles form and break on the anode with mechanical regularity, thereby causing an interrupted current flow. How simple it sounds! But somehow or other the bubbles fail to form and break regularly and, taken with the rapid heating properties of an interruptor of the electrolytic type, generally cause it to be a rather unsatisfactory piece of apparatus.

In the case of a water cooled, platinum electrode electrolytic interruptor, the above difficulties are usually not present, but the prohibitive cost of this instrument bars it from the majority of amateur stations.

As a parallel case to the above, we find the spark



Mercury interruptor made out of an electric bell.

coil vibrator, unless of expensive make, to be generally unsatisfactory and inefficient.

A form of interruptor which has met with a great deal of approval among the advanced class of experimenters, is the mercury independent type. Singularly enough, this unique and efficient form of current breaker, which is employed extensively in electrical work on account of its positive operation, has been neglected almost entirely by the amateur wireless experimenter, usually so prompt in adopting a new idea, provided he is justified in doing so.

We will attempt in this article to acquaint the experimenter with a simple and cheap, though efficient, form of the mercury interruptor for wireless use.

From an ordinary electric house bell saw off the jutting arm which supports the bell. Remove the round clapper from the end of the vibrator and solder a ⅛-inch round brass rod about 2 inches long in its place. Bend the extended part of the vibrator at right angles to its usual position and parallel to the magnets and mount the bell base to square wood standards erected to a wood or rubber base having the dimensions of ¾ by 3 by 6 inches.

If the magnets are now actuated, the brass rod will vibrate up and down with about a ¼-inch stroke.

A small brass cup, 1 inch deep and ¾ inch wide, should now be procured and a hole tapped into the bottom to accommodate an 8/32 thread. A machine screw passing up through a counter-sunk hole in the base, located directly under the brass plunger, will secure it firmly. By bending the extended portion of the armature, the plunger should be adjusted so that its lower end is ⅜ inch below the level of the top of the cup. The cup should then be filled with mercury to a level ⅛ inch below the end of the plunger. A good grade of light cylinder oil should then be poured over the mercury until it is about level with the top of the cup. This will quench any arc that might possibly form and, incidentally, will prevent the mercury from splashing out.

In operation, several dry cells are required to actuate the magnets. The vibrator of the spark coil should be screwed down tight, the battery circuit switched on and the contact screw of the completed interruptor adjusted until the desired spark frequency is obtained. A little practice in this direction will accomplish the desired results.

The mercury interruptor above described requires little or no attention and is practically non-heating. If used on the regular lighting current, either alternating or direct, a water rheostat should be provided, as the resistance of this interruptor, unlike the electrolytic, is very low and 110 volts would prove too strong for both itself and the spark coil.

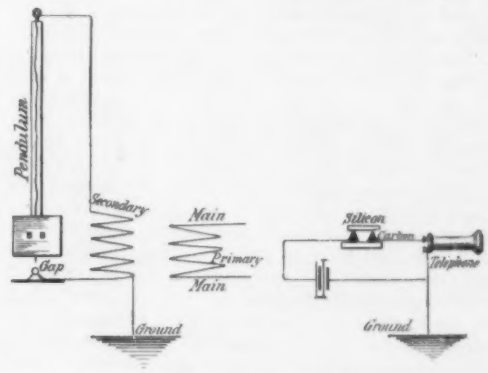
A Seconds Pendulum

By C. C. Kiplinger

A SECONDS pendulum is frequently used in the physics laboratory. After an extended experience with unsatisfactory contact pendulums of the mercurial type, the following instrument was devised which has proved itself successful in practical use. The details of the contrivance are shown in the sketch.

A wooden rod (a meter stick does nicely) has a screw eye attached at one end. This is filed to a knife edge, so as to form a frictionless point of support. The fixed knife edge is made from a small file, also brought to a sharp edge by means of a second file. Two plates of thick sheet lead and two short bolts comprise the bob of the pendulum. A short length of wire fastened to one of the plates and lying in the axis of the rod, serves for one terminal of a small spark gap. The other terminal may be either a small metallic ball or rod with rounded ends.

The connections should be made with a transformer or induction coil and the ground, as shown in the figure. A short gap should be used and the spark should be but little longer than the gap in order to insure a vertical spark. With the apparatus in working order, every



Seconds pendulum as a wireless transmitter.

swing of the pendulum gives rise to a spark, which in turn sends out electro-magnetic disturbances into space.

The instruments used for the detection of these disturbances are, a 75 ohm telephone receiver, a modified Massie's oscillaphone, and two dry cells, connected as shown in the sketch. The oscillaphone comprises two carbon knife edges insulated from each other and about 3/16 of an inch apart. A piece of silicon is laid across the edges. A piece of galena or a light sewing needle may also be used. Under the conditions in which we work, silicon has proved far more sensitive. The silicon should be moved to and fro on the carbon supports until the signals are loudest.

Any desired number of detectors may be operated by the "master pendulum," and these may be in different rooms, or in an adjacent building. Such a pendulum will be found far superior to the ordinary type.

The Department of Terrestrial Magnetism of the Carnegie Institution, the all-important center of world-wide magnetic surveys, is at last to have its own offices and laboratories in Washington, after having been domiciled in an apartment house ever since it was founded. A site of about seven acres has been purchased in the same suburban district of the capital which includes the Bureau of Standards and the Carnegie Geophysical Laboratory, and the new buildings are expected to be ready for occupancy early next year. The magnetic survey yacht "Carnegie," attached to this institution, early this year crossed the South Atlantic from the Falkland Islands to St. Helena, and then returned to the South American side. She is due in the United States at the end of the year, after three years of circumnavigating the globe. Dr. L. A. Bauer, director of the department, is to deliver the Halley lecture on "Terrestrial Magnetism" at the University of Oxford, May 22nd. 1914.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Recent Improvements in the Reciprocating Engine Art

IT is generally conceded that the reciprocating engine has reached a very high stage of development, that there can be no radical departure from the universally accepted engine construction without serious loss in efficiency.

The direction of improvement, and, indeed, the proper direction, has been in working between the widest attainable limits of temperature.

Steam must enter the machine at the highest possible temperature, must be protected from waste and must retain, at the moment before exhaust, the least possible amount of heat. Among the inventors who have recently been working along this line is Prof. Johann Stumpf of Berlin, whose engine is of the type known as the "uni-directional flow" steam engine. In such engines, as distinguished from "counter flow" engines, the steam once admitted into the cylinder does not return in its path. The steam is permitted to enter each end of the cylinder alternately and exhausts through a set of ports which encircle the middle of the cylinder, these exhaust ports being controlled by the piston at the end of its stroke.

In the figure, the steam, instead of being introduced into the cylinder direct, enters it from the hollow head A^1 through the inlet B, thus providing a live steam jacket so that the steam is neither cooled nor condensed. This steam is cut off and expands, moving the piston forward or backward, as the case may be, until at the end of the stroke the piston uncovers the ports C. The steam never returns in its path from the inlet to the exhaust, hence the term "uni-directional flow."

A jet condenser E is placed in a box D^2 of the exhaust pipe D^1 in order to cool the exhaust additionally to facilitate the sweeping out of the exhaust steam.

This construction provides a hot inlet and a cool exhaust, and there is a gradual fall in temperature from the inlet to the exhaust, the working steam at the end of expansion being arranged in layers of decreasing dryness.

An enormous drop in temperature of the steam takes place during the expansion and exhaust of the steam, and the heat, therefore, passes rapidly from the hot jacket to that layer of steam adjacent thereto. The heat thus flowing toward the exhaust belt is to a great extent absorbed by the working steam and is trapped by the piston at the commencement of the compression stroke, instead of being swept out of the exhaust, so that this heat, transferred to the steam, is again transmitted to the end of the cylinder by the pumping action of the piston. The heat given up by the cylinder head to the steam in the cylinder is retained within the latter, since this steam is itself retained therein, so that the head presents the peculiar phenomenon of a heating jacket with no loss.

In actual tests it has been found, when employing superheated steam, that the temperature of the cylinder wall at the inlet is higher than the temperature of the steam in the jacket. In uni-directional steam engines the points at which release and compression begin are never varied, so that, in an engine properly designed for its normal load, the compression is excessive when the engine is starting or running at high loads.

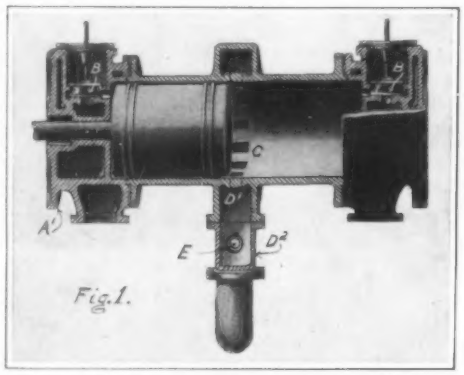
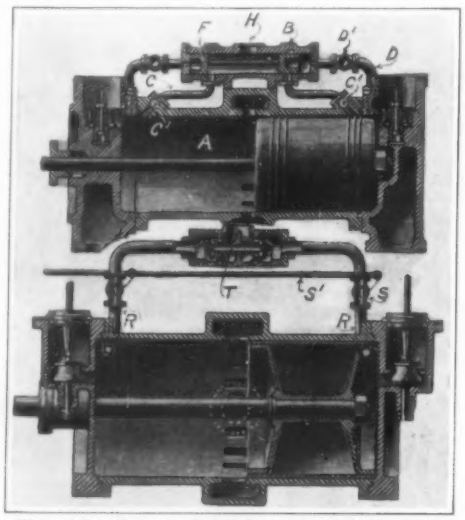


Fig. 1.—Uni-directional flow condensing engine.



Figs. 2-3.—Forms of uni-directional flow engines.

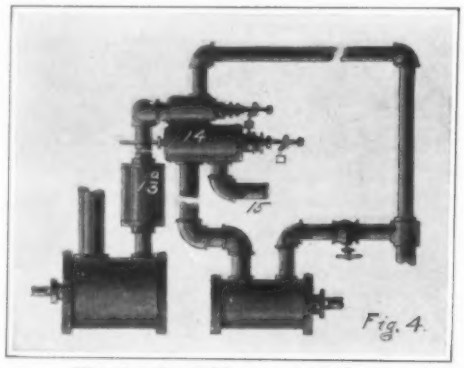


Fig. 4.—Controlling gear in place.

Prof. Stumpf has recently patented a device whereby this excessive compression may be relieved. This device consists of an auxiliary exhaust valve which is connected to the cylinder and operates automatically. This valve may be cut out when not required, without interfering with the economic working of the engine during normal running.

The figures show two variations of this invention. In Fig. 2, the cylinder A, in which the piston moves, has auxiliary exhaust passages leading from the inlets, which passages are controlled by valves C^3. These passages have pipes leading to a valve chamber in which there is located a steam operated valve, shown at F. The valve casing B is connected to the live steam inlet by means of a pipe D manually controlled by the valve D^1.

The entering steam, the valves C^3 being open, passes into the cylinder and also through the pipe D into the casing B, and the valve F moves to the opposite end of the casing, uncovering the port C. The steam may then not only exhaust through the main exhaust ports controlled by the piston, but also through the passage C to the casing B and port H. This exhaust continues until the compression pressure on the one side of the piston is greater than on the other, the auxiliary exhaust continuing for a considerable part of the stroke, whereby only a low compression is attained, such as is sufficient to meet the requirements during starting or at high loads.

In Fig. 3, the pipe C is omitted and the valve T is actuated by the auxiliary exhaust pressure through the pipe R controlled by the valve S instead of the live steam as in Fig. 2. The operation of the device shown in Fig. 3 is precisely the same as in Fig. 2, except that the exhaust steam operates the valve T instead of the live steam. The valves S are operated simultaneously by the rod S^1 and the valve T is of different construction.

By closing the valves D^1, C^3 and S, when not required, the economic operation of the engine during normal running is not interfered with.

In the operation of blast furnaces it is necessary frequently to slow down one or both engines, and often it is desirable to run the high pressure engine alone or the low pressure engine alone, using boiler steam. This result is ordinarily secured by placing throttle and stop valves in the piping between the high and low pressure engines, and providing a separate throttle and a pressure reducing valve for admitting boiler steam at reduced pressure to the low pressure cylinder. A safety valve is placed on the receiver, or on the pipe between the high and low pressure cylinders, to allow the high pressure cylinder to exhaust outboard in case the receiver pressure builds up too high. These valves are all separate, and all except the safety and

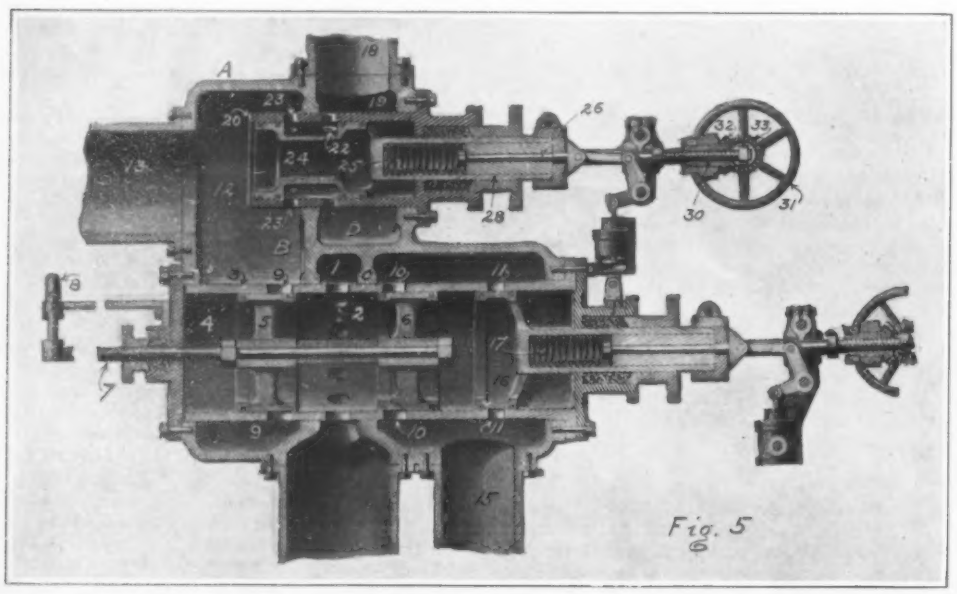


Fig. 5.—Detail of controlling gear shown in connection with cylinders and boiler in Fig. 4.

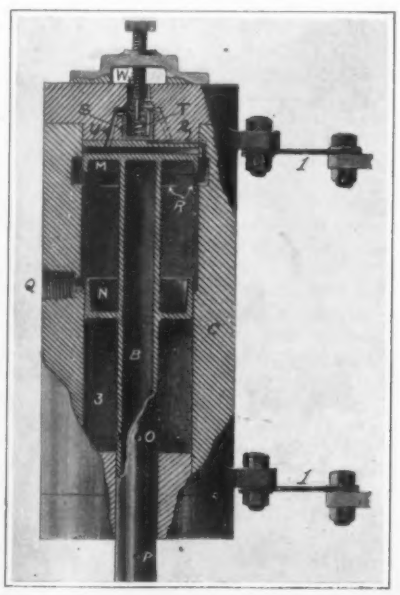


Fig. 6.—Reciprocating elements and valve

reducing valves are manually operated.

Properly manipulated and with due regard to sequence, they produce the desired results with fair success, but it is clear that the opening or closing of the right valves in wrong sequence or opening or closing the wrong valves in right sequence, may cause one or both of the engines to stop. Cessation of the blast which would follow stoppage of both engines is a serious matter in blast furnace operation, one of the consequent dangers being serious explosions of gases that work back into the blowing tube from the furnace.

An interesting invention which performs all the functions of the above-mentioned valves, many of them automatically, renders it impossible to start or to stop both engines by the manipulation of a single valve, and makes it impossible for accidental stoppage of one engine to cause the stoppage of the other, has recently been patented by F. E. Norton of Youngstown, Ohio.

The Norton controlling gear, which is shown in Figs. 4 and 5, employs a casing *A* (Fig. 5) with partitions *B*, *C* and *D*, located between the high and low pressure cylinders. Two cylindrical shells 3 and 20 are placed in the casing *A*, thus providing two valve chambers in which the valves 5, 6, 16 and 24 are placed. The annular chamber 1 formed by the partitions is connected by a pipe to the exhaust of the high pressure cylinder and communicates with the valve chamber 4 through the ports 2. The valve rod 7 is manually adjustable by the lever 8 so as to cover or to uncover the ports 9 and 10. The valves are so posited on the rod 7 that the ports 2 are never covered by the valves 5 or 6 within the limits of their travel; that both ports 9 and 10 are closed in their mid-position; and that ports 9 are closed when ports 10 are open, and *vice versa*.

The ports 9 lead to the chamber 12, communicating through the pipe 13 to the receiver 13*a*. (See Fig. 4.) The ports 10 lead to the annular chamber 14, communicating through the auxiliary exhaust connection 15 to the condenser or atmosphere. The ports 11 are normally closed by the spring operated valve 16, the latter being forced to opening position against the resistance of the spring 17 by excess of pressure in the chamber 4.

Boiler steam is introduced by the pipe 18 into the chamber 19 and thence into the valve cylinder through the ports 22. The valve 24 is normally held is open position by the spring 25, permitting the steam to pass through the ports 23 into the chamber 12, but capable of being forced to the right to a closing position by pressure in the chamber 12 acting on the plunger 28. The pressure on the chamber 12 may be varied by changing the compression of the spring 25. This is accomplished in the same manner and by the same mechanism used in changing the compression of the spring 17. The rotation of the nut 30 by the hand wheel 31 through the gears 32 and 33 causes the rod 26 to vary the stress on the spring 25 at the opening position of the valve 24. It will thus be obvious that the valve 24 serves both as an adjustable pressure reducing valve and as a positively controlled throttle valve. Sudden movements of this valve are checked by the dash pot, sleeve and link arrangement, thereby securing a smoother action.

The operation of the device is as follows: Assuming that the valves 5 and 6 are to the right, giving free exhaust through ports 10 and closing ports 9, the low pressure engine would next be started by manipulating valve 24 by means of the hand wheel 31 until open enough to start and run the low pressure engine on boiler steam from pipe 18. The valve 24 would act as a pressure reducing valve, controlling the pressure in the chamber 12 through the agency of said pressure acting on the end of the plunger sleeve 28, and the opposition or resistance of spring 25 thereto.

Conditions now are: Valves 5 and 6 to the right; ports 9 and 11, closed; ports 10, open; ports 23, partially and variably open, and maintaining approximately constant pressure in chamber 12.

This manipulation of the parts runs the engine "simple."

To compound the engines, the spring 17 is adjusted to a pressure very slightly higher than the desired receiver pressure, an adjustment seldom requiring attention; then the spring 25 is set so that valve 24 will open at a pressure very slightly below desired receiver pressure; lastly, valves 5 and 6 are moved to their extreme left position by means of handle 8 acting on rod 7. The engines will now operate "compound."

Conditions now are: Ports 9, open; ports 10, closed; ports 23, closed, but ready to open if pressure in chamber 12 falls; ports 11, closed, but ready to open if pressure in chamber 4 rises.

If the high pressure engine be now accidentally stopped, valve 24 will open and supply steam to the low pressure engine, so that it will continue to run. If the low pressure engine be accidentally stopped, valve 16 will open ports 11 and allow the high pressure engine to exhaust in the pipe 15 so that it will continue to run. Normal method of stopping either engine: First convert to single expansion operation by moving valves 5 and 6 to the right; then to stop high pressure engine alone, close throttle, or to stop low pressure engine alone, draw valve 24 to closed position by the action of wheel 31.

This construction affords ease of manipulation and freedom from accidental stoppage, the evil effects of which have been explained.

In wool combing machines a rapid reciprocatory motion without undue vibration is required to operate the brush or dabber which drives the wool fibers into the spaces between the projecting needles. Most machines now used, even with carefully constructed, oppositely moving balance weights, positively operated, are subject to a residual tremor which is very disadvantageous.

A patent recently granted to Boys and Tierney shows a reciprocating engine for producing such a rapid reciprocatory motion to operate the brush or dabber of a wool combing machine.

In Fig. 6, the hollow piston rod *B* is attached to the brush of a wool combing machine, or to a mold box, or to any other device required to be reciprocated rapidly where little external work is required. The piston with its heads *M* and *N* comprises the working element of the machine and the cylinder C in which the piston operates is attached to the wool combing machine frame by means of the springs 1.

Live air or steam is admitted to the port *Q* and the space between the heads of the piston is filled with the motive fluid, which acting on the larger head *M* lifts the piston until the grooves *R* are uncovered. The air then passes through these grooves and through the small passage 2 to the upper side of the valve *S*, forcing the valve upward against its spring *T* and closing the exhaust passage *W* from the space above the piston. Part of the air also passes to the space above the piston, where it is compressed and acts as an air buffer or elastic fluid spring. The pressure in this space now becomes equal to that in the space between the two heads of the piston and greater than that in the space 3 below the head *N*, and the whole piston is driven downward, compressing the air in that space. The exhaust valve *S* remains closed until the pressure in the space above the piston falls in consequence of expansion to such an extent that the spring *T* overcomes the air pressure on the lower side of the valve, when the valve opens and exhaust takes place.

The compressed air or air spring in the space 3 then arrests the downward motion of the piston and drives it upward again and the valve *S* will again close at a definite point of the upward movement of the piston, depending on its velocity and on the capacity of the passages *U* and the consequent pressure arising in the grooves *R* and passage 2.

The period of the stroke at which the exhaust valve opens and closes is regulated by the screw. The passages *O* and *P* are provided to allow air to exhaust from or to enter the space 3 near the end of the stroke and so prevent creeping of the piston in the cylinder and ultimate stoppage of its motion.

It will be observed that the trapped air below as well as above the piston, by its compression, is most effective in returning the piston quickly, and this is one of the advantages of this method of effecting the reciprocation for extreme rapidity over the method of eccentric driving now commonly used.

Notes for Inventors

A Doll With Different Faces.—Chester Lombra of Meriden, Conn., has secured a patent, No. 1,059,178, for a doll which has a fixed face and an extra face or faces hinged at the lower edge of the fixed face so that they can be turned down against the body of the doll or up over the exposed face, a bandeau being provided to hold the upper edge of the movable face when the latter is adjusted to position for use.

An India Rubber Substitute.—A process of producing an India rubber substitute is described in the patent, No. 1,061,881, to Julius Stockhausen of Crefeld, Germany. In this process gelatin is mixed with glycerine and with camphor, the latter being dissolved in acetone and the mass is treated with sulphur.

Artificial Signal Clouds.—Stephen J. Kübel of Washington, D. C., has patented a method of signaling, No. 1,062,782, in which cloud-like bodies are formed by chemical reaction and their discharge is controlled in accordance with the signal desired to be given. In discharging the cloud-like bodies, fluid pressure is utilized.

A Cranberry Dryer.—A patent, No. 1,032,969, has been issued to Henry H. Harrison of Boston, Mass., for a dried entire cranberry having a vented skin and for the process of drying fruit in which the interior of the fruit is vented through the outside thereof while retaining the integrity of the fruit; the vented fruit is afterward subjected to the action of a drying agent.

A Process for Tempering Copper.—William H. White of Hazleton, Pennsylvania, assignor of one half to W. D. White, of Hazleton, and one third to Jacob M. and Margaret Schappert of Dorranceton, Pa., has patented, No. 1,062,067, a process of tempering copper wherein the copper is heated to a high temperature and is immersed in a hardening bath containing lime water from which it is removed as soon as it blows and is then placed upon a hard surface and struck with another hard surface.

A Way to Prevent and Cure Premature Baldness.—A patent, No. 1,062,025, to Bernard H. Nichols of Ravenna, O., shows a hat band having corrugations on its sides which form protrusions and depressions, the purpose of the construction being to avoid interference with the free circulation of the blood to the scalp whereby the patentee claims to prevent and cure premature baldness.

Electrical Rat Trap.—Henry Carter of Pittsburgh, Pa., as assignee of one half, has received with Raymond H. Pryor of same place, patent No. 1,052.957 for a rat trap in which there is a platform, an electrocuting circuit and a motor circuit controlled by the movements of the platform, the motor circuit acting to operate a clearing mechanism by which the rat will be thrown away from the trap after it has been electrocuted by stepping on the platform.

A Phonograph and Kinematograph Synchronizing Device.—In patent No. 1,053,946, issued to the assignee of Leon Gaumont of Paris, France, is shown a synchronizing apparatus in which a phonograph mechanism and a kinematograph motor are coupled with means controlled by one of said mechanism and operating to control the speed of the other mechanism, with the controlling means including a plurality of contacts connected in multiple with the field winding of the kinematograph motor.

Improved Flexible Tubing.—In patent No. 1,053,394, to Henry Hubbell of Ashburnham, Mass., assignor to N. T. R. Almond Manufacturing Company, same place, is shown a flexible tubing which has an inner coil and an outer coil which is located between the convolutions of the inner coil with the inner surfaces of the convolutions of the outer coil given an ogee shape in cross section and engaging with the inner coil along a relatively narrow line in the normal position of the tubing.

Bill Nye's Prophetic Vision.—Many years ago, before the days of the phonograph, Bill Nye wrote a humorous suggestion that an automatic machine be used for the delivery of political speeches from car platforms. Bill Nye little suspected how soon talking machines would be reeling off political speeches all over this land of ours. They were used in the last presidential as well as in the one four years before. When skillfully employed they avoided "repetition or the wrongful application of local gags" which Bill Nye claimed as a great advantage of his proposed political machine.

A Novel Photographic Process.—A patent whose purpose is to provide for photographing an object with any desired background has been issued, No. 1,053,887, to Hugo Sonntag, of Erfurt, Germany. This patent includes a translucent screen slightly tinted with a non-actinic color or a color having a weak actinic action. This screen is located behind the object and the face side of the object is lighted and the sensitized plate or film is subjected to a single exposure to simultaneously impress therein the images of the object and the projecting background, the background being projected upon the translucent screen from the opposite side thereof to that occupied by the object to be photographed.

First Superintendent of Patent Office.—There hangs in the office of the Commissioner of Patents at Washington a portrait of Dr. Wm. Thornton, the first superintendent of the Patent Office. The picture was painted by Gilbert Stuart whose portraits of George Washington are justly celebrated. The portrait was presented to the Patent Office in 1871 by a niece of Dr. Thornton, Mrs. Talbot, widow of Hon. Isham Talbot, U. S. Senator from Kentucky. Dr. Thornton was an intimate friend of President Washington, who, in 1794 appointed him one of three commissioners to survey and lay out the Federal capital. The Patent Office for most of the Doctor's administration was not very extensive, as we are told it consisted in 1816 of three persons: Dr. William Thornton, superintendent, at $1,400, William Elliot, clerk, at $500, and Benjamin Fenwick, messenger, at $72.

Three Wardrobe Trunk Patents.—The popularity of so-called wardrobe trunks is manifested in three patents, Nos. 1,051,936, 1,051,937 and 1,051,938, issued to George H. Wheary of Racine, Wis. The patent, No. 1,051,936, includes a novel construction of folding wardrobe section inside of which legs are pivoted and adapted to be swung into position to support the wardrobe section when the latter is adjusted out of the trunk body and raised to an upright position. The patent, No. 1,051,937, provides a folding rack in connection with a swinging door, the rack being arranged to engage the door when the latter is partially closed in such manner as to forcibly close and lock the door in position when the rack is folded out of position for use. The third patent, No. 1,051,938, has the trunk body provided with an end wall which is mounted to swing outward and rest flat down upon the floor, and the wardrobe section includes a rectangular tray, one end of which is provided with means co-operating with means on the swinging end wall of the trunk body whereby the tray may be secured to the said end wall when the said wardrobe tray is adjusted to upright position for use as a wardrobe.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

SKIRT.—H. LEIBHOLZ, 127 W. 25th St., Manhattan, N. Y., N. Y. In the present patent the aim of the inventor is to provide a new and improved skirt or petticoat, arranged to readily fit persons of different waist measure, and to insure proper hang of the garment, especially over the hips of the wearer.

Pertaining to Aviation.

FLYING MACHINE.—F. L. SCHAUFLER, Mattoon, Ill. An object here is to provide a properly balanced machine supported by wheels which are resiliently and adjustably connected to the frame thereof, so as to lessen the shock in riding over the ground and descending from the air onto the ground.

Of Interest to Farmers.

BROOM CORN CLEANING MACHINE.—E. CORY, Colfax, Ind. In this case the purpose of the inventor is to provide a new and improved broom corn cleaning machine, arranged to thresh out the seeds from the heads and simultaneously trim the butts with a view to produce stalks of even length.

Of General Interest.

COMPOSITION FOR IMPRESSION SHEETS.—A. W. HANINGTON, A. ROSENSTEIN and R. A. SOUTHWARD, care of Alfred Rosenstein, 186 Lafayette St., New York, N. Y. In this invention, an object is to produce a new and improved impression sheet by means of a new composition and method, which, when applied in a certain manner, which is believed to be new, can be reproduced a number of times.

STREET SIGN.—J. DONOVAN, chief of police, Port Chester, N. Y. A horizontal bar attached to a wall or pole, supports an upper and a lower plate parallel to the streets, the names of which they bear, respectively. By the provision of a slot in the bar and the flange of the lower plate the amount of adjustment needed is secured to enable the parts to be conveniently fitted together when mounted on the support or post which carries them.

TOOTH BRUSH.—J. T. RANKIN, Station A-2637 Pasadena Ave., Los Angeles, Cal. An object of this invention is to provide a device which may be attached to a handle of any brush whose bristles have become worn by merely cutting off the bristles and securing a removable attachment, which last is desirable from a sanitary standpoint.

COMPOSITION OF MATTER.—A. G. HARRIS, P. O. Box 786, Lincoln, Neb. This composition is of the nature of concrete, but has many marked advantages over the latter, among which is that of strength, i. e., resistance to compression or tension, capability of withstanding vibrations or shocks, ability to deaden sound vibrations, non-combustibility, light weight, and beautiful appearance when used for building purposes.

ATTACHMENT FOR SHOE BRUSHES.—J. E. KENKEL, care of Will J. Beecher, Great Falls, Mont. This device is attachable to the back of an ordinary shoe brush, and has provision for holding a box of polish and a dauber. The invention has means for holding polish boxes of various sizes, in such a manner that the box will be securely held in place regardless of the position in which the brush is held.

FLOOD GATE.—A. S. GALBRAITH, Bakerfield, Mo. This device is composed of separable units, and is capable of being increased or decreased in length for streams of different sizes, normally in erect position to prevent the passage of live stock, but capable of swinging out of position to permit the passage of drift, and automatically returned to position after the passage of drift.

WRINKLE PREVENTER.—CHARLOTTE J. MCDONALD, 57 Cadigan Square, London, England. This preventer is worn by a person in repose especially during the night while asleep, and is arranged to prevent the face and more notably the cheeks from coming in contact with the pillow or other head rest, so that the free circulation of the blood is unhampered, and not drawn or wrinkled up by contact with the pillow, and hence the formation of wrinkles is prevented.

FOLLOWER FOR FILING APPARATUS.—J. A. BEST, Augusta, Ga. The invention relates generally to filing apparatus, and more particularly to a follower or a card supporting member, the object being to provide a follower having means whereby it may be readily and effectively secured in adjusted position and quickly and easily released when desired.

LOCKING DEVICE FOR FILING APPARATUS.—J. A. BEST, Augusta, Ga. The object of the present invention is the provision of a locking device by the use of which one or a number of non-alined series of cards may be locked against accidental displacement or removal by unauthorized persons.

LARD CUTTER.—A. W. BLAUL and L. HARMISON, Cumberland, Md. The invention provides a device by means of which lard or other similar substance such as butter, etc., may be cut from a container which holds the same in bulk and at the same time may be forced into a dispensing receptacle which may be subsequently taken from the cutting device.

CASTING APPARATUS.—E. C. WILLS, P. O. Box 172, Frederick, Md. A purpose here is to provide a casting apparatus in which objects may be molded with great rapidity and at small cost. Further, to provide a mold construction in which there are slidable and movable mold sections to permit the casting of objects of irregular shape.

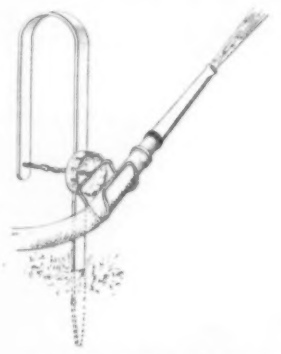
COAL WASHER AND ORE CONCENTRATOR.—A. C. CAMPBELL, Asheville, N. C. In the present invention the object is to provide a machine arranged to prevent back sliding of such densities of the material under treatment as should go forward, and to insure the movement of all the material in the proper directions so that the capacity of the machine is increased as the working surface has a great jigging and panning effect to hasten concentration and also to hasten on discharge of heads.

ARTIST'S COLOR BOX AND EASEL.—L. E. KUHRT, 983 Sixth Ave., Manhattan, N. Y., N. Y. This inventor provides a box mounted on supporting legs in position to hold a sketch panel, or other device; provides means for locking the box in adjusted position; provides means for holding a canvas in working position; provides a box, one side whereof forms a holding-tray for tubes and tools used in sketching; and provides means for packing the box and parts connected therewith to form a small and convenient bundle.

Hardware and Tools.

TAPPING DEVICE.—O. H. HINMAN, Kensington, Kan. In this instance the invention has for its object the provision of an inexpensive device for tapping a pipe containing a fluid, under pressure, without the loss of the fluid, and where the pipes are too thin for cutting threaded openings therein.

ADJUSTABLE HOSE HOLDER.—L. P. BAILEY, Box 132, Mountain View, Cal. This invention relates to hose holders, the object being to provide a simple, strong and inexpensive device by which the nozzle end of an ordinary hose may be conveniently and effectively held in various degrees of inclination



ADJUSTABLE HOSE HOLDER.

an example of the practical application of which is shown in the accompanying illustration. The parts are extremely inexpensive and ready and simple of adjustment, and by reason of their weight may be readily transported from place to place.

WRENCH.—W. E. P., care of SCIENTIFIC AMERICAN, 361 Broadway, New York, N. Y. In the present patent the invention has reference to the provision of a novel locking block to engage the movable jaw of the wrench to permit of the adjustment of the movable jaw and lock the same in adjusted position.

FLOOR SPRING HINGE.—O. KATZENBERGER, c. o. Lawson Mfg. Co., 215 W. Huron St., Chicago, Ill. The purpose of this invention is to provide in a spring hinge a cam and co-acting roller structure formed with roller sleeves at the ends arranged in guiding slots whereby the hinge operates with a minimum friction, while retaining the body of the hinge in proper position.

SAFETY RAZOR.—L. J. FAY, P. O. Box 182, Watts, Cal. The blade is held in place by a tube compressor, and as the guard is movable it may be adjusted to position to permit the cleaning of the razor without unscrewing or taking it to pieces during shaving. If beard is heavy the first time over may be shaved with the guard raised and then lowered for a close shave, or the razor may be used with the guard removed, thus forming an ordinary razor.

SAFETY DOOR HASP.—J. B. CRANE, 111 N. Pearl St., Ellensburg, Wash. The improvement pertains to hand operated fasteners for barn doors or the like, and particularly refers to devices of this nature which are intended to make it impossible for a door thus secured to be opened by a horse or for the door to be rattled or shaken loose by any other means.

LEVEL AND THE LIKE.—A. C. W. ALDIS, Old Grange road, Sparkhill, Birmingham, England. The invention comprises the employment of the fluid bubble in an optical system to act as a lens, that is, the surface of the bubble forms one of the refractive or reflective surfaces in the optical system so that the movements of an image due to displacement of the bubble can be viewed directly or by projection on a screen.

CORK PULLER.—A. FINSEL, 47 Broadway, Elizabeth, N. J. This invention relates to cork pullers and has particular reference to a convenient tool for extracting corks of any size or construction in a manner which will insure positive delivery of the corks intact so that they may be re-used, if desired. The tool removes crimped caps from bottles.

PIPE CUTTER.—W. H. JOHNSON, Waco, Tex. The intention here is to provide a device by means of which a portion of the material of the pipe is removed to form the cut, instead of the material being displaced and wedged apart without removing.

MONKEY WRENCH.—T. C. DOREDANT, 3913 Camp St., New Orleans, La. The main purpose of the improvement is to produce a wrench having means for permitting a quick adjustment of the movable jaw. Further, to provide in connection with the means for adjusting the movable jaw, an improved latch device for holding the movable jaw in the adjusted position.

TEMPLET.—H. B. ASH, St. Louis, Mo. Address the Offill-Thon Mfg. Co., Ashley, Ill. Templets are for use in preparing the metallic parts for iron or steel structural work, acting as a temporary guide or pattern for locating the several bolt or rivet holes. The object here is to provide a templet which may be produced at a greatly reduced cost, and which will permit of easy and speedy manipulation in assembling and disassembling.

Heating and Lighting.

GAS ILLUMINATED ADVERTISING APPARATUS.—F. O. SEYD, London, England. Address Day, Davies & Hunt, 321 High Holborn, London, England. In the present patent the invention has for its object the provision of a simple and inexpensive valve mechanism which may be readily adjusted, will require a small amount of motive power to actuate it, and may utilize the gas pressure in preventing leakage.

GASOLINE LIGHTING APPARATUS.—A. T. ROCHTE, McClure, O. Address Orville Smith, Napoleon, Ohio. Mr. Rochte's invention is an improvement in gasoline lighting apparatus, and the object is to provide an easily operated and economical apparatus for gasifying the gasoline and delivering it to the burner mixed with a suitable quantity of air.

OIL BURNER.—A. D. MARCOTTE, Eunice, La. An object of the invention is to provide a device for burning heavy or low grade oil, so as to effect a complete combustion thereof, and obviating the annoyance of smoke which often accompanies the burning of oils of this character.

Household Utilities.

TAKE DOWN COOK RANGE.—G. FRAZER, care of Eugene Iron Works, Eugene, Ore. The present invention relates generally to stoves and more particularly to cook ranges, the object being the provision of a cook range which may be taken down and conveniently packed upon the back of an animal used for such purposes.

CLOSET.—E. M. ANDERSON, 813 E. 13th St., Winfield, Kan. The invention applies more particularly to closets which cannot be connected to a sewer, but must rely on a dry pit or tray; and to also make the closet fly-proof. It provides a closet wherein the opening to the vault is automatically closed when not in use, and a ventilating flue provides for the escapement of obnoxious gases.

CLOTHES LINE SUPPORT.—A. OLANDER, 4002 Eighth Ave., Brooklyn, N. Y. This support is for use particularly in tenement houses and places where the line is attached to the framework of a window, or near a window. The invention permits the line to be extended into the room through the window during placing of clothes thereon, and after such placing the end of the line extending into the room may be removed without changing the tension of the line.

LIGHTING AND VENTILATING APPARATUS.—J. O. ULRICH, Tamaqua, Pa. The device may be arranged in any desired position and is operated from the floor. A perfect circulation of air may be obtained, by bringing the perforate sheets of the frames into register with the perforate sheets of openings.

PORTABLE SHOWER BATH.—C. F. NORDMARK, 91 W. Neptune St., W. Lynn, Mass. This shower bath can be easily moved and the energy required for raising the water above the bather is supplied by the bather himself. These features are obtained by providing a movable inclosure or cabinet carrying a pump, which is actuated by the bather, and sprinklers properly dispensed in the inclosure.

TOWEL RACK.—A. H. HOWE, 575 Trinity Ave., Bronx, N. Y., N. Y. This invention is especially intended for use with hot water boilers used with kitchen ranges, the arrangement of parts being such that an article of this class may be produced at a low cost and sold at a corresponding price.

FLOAT VALVE.—F. SCHUH, 35 Elm St., Albany, N. Y. The invention relates to flushing tanks and provides a float-controlled inlet valve, arranged to insure a proper opening and closing of the valve against the pressure of the water supply to direct the incoming water in a downward direction, to prevent upward squirting, at the same time rendering the valve practically noiseless, to render the valve self-cleaning of sediment and other extraneous matter and to prevent the valve from sticking.

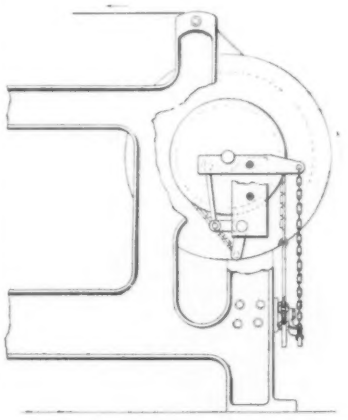
MOP.—T. W. LESLIE, 179 Nostrand Ave., Brooklyn, N. Y. This invention refers to improvements in mops, and the object is to produce a construction which is especially adapted to wipe up the moisture on floors, counters, stands, or any other place that requires to be cleaned and dried.

RANGE AND STOVE.—E. C. COLE, Cole Mfg. Co., 3218-38 S. Western Ave., Chicago, Ill. Heretofore manufacturers laid asbestos over the top oven plate inside the top flue; or, in a cast range, to cast ribs, and plaster in fire clay in order to keep the top oven heat from being too great, and on the firebox end of the oven, there has been an air space between the oven plate and the cast iron back walls of the firebox. This causes the back walls of the firebox to burn out very quickly. For the improvement of these conditions the invention lies particularly in the means for ventilating and controlling or balancing the oven heat.

PERCOLATOR.—J. J. O'MARA, 1975 E. 8th St., Brooklyn, New York. This device comprises a main vessel, a heating chamber having an outlet projecting into the main vessel, a percolating tube to convey heated fluid from the chamber to the material from which the infusion is to be made, and a telescopic union for removably connecting the tube and the outlet part of the chamber, the union having a tortuous passage whereby the fluid can enter the chamber from the main vessel.

Machines and Mechanical Devices.

LET-OFF MOTION FOR LOOMS.—I. COULOMBE, 53 Riverview St., Fall River, Mass. Mr. Coulombe's invention is an improvement in let-off motions for looms, and has for its object the provision of a device of the character specified, wherein the tension on the warp beam is controlled by the weight of the yarn on the beam, and wherein the arrangement is such that the said weight acts upon both ends of the brake band to tighten the same to regulate the tension thereof.



LET-OFF MOTION FOR LOOMS.

BRAKE BELT LINK.—I. COULOMBE, 53 Riverview St., Fall River, Mass. This inventor furnishes an improvement in brake belt links, which has for its object the provision of a simple, inexpensive device composed of a series of interchanging links, each of which carries an inset of cork, extending beyond one face of the link.

OZONE PRODUCING MACHINE.—D. C. SMITH and F. M. HUMMEL, 715 Grand Ave., Des Moines, Iowa. An object of the invention is to provide a device in which a maximum amount of ozone may be produced with a minimum expenditure of energy. Another object of the invention is to provide means for centering the discharge terminals, so that the latter may be at once brought into their proper position.

ROTARY PUMP.—W. A. SIMOND, 76 Pleasant St., Franklin, N. H. This invention has reference to rotary or centrifugal pumps for water or other fluids, and such as are adapted for use on shafts which are vertical or inclined to any extent. The pump comprises a casing adapted to be introduced into or to be located in any place from which water or other fluid is to be pumped, as a well, hold of a vessel or the like.

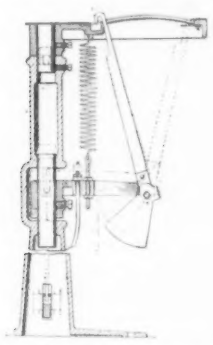
INDICATING MEANS FOR ROLL FILMS.—H. M. ENGLE, Room 414, National Exchange Bank Bldg., Roanoke, Va. This invention provides indicating means for roll films arranged to enable the user of the camera containing the roll film to observe the unwinding of the film without unduly straining the eyes, or constantly looking at the camera window to prevent over-winding or under-winding of the film, and to allow of quickly winding the film thus avoiding delay in making successive exposures.

SIPHON CHARGING MECHANISM.—H. S. WINSOR, care of J. S. Jenkins, 165 Broadway, New York, N. Y. The principal object of this inventor is to provide a siphon charging mechanism embodying a substantial structure and a number of co-operating parts, whereby siphons may be charged with a gas contained in a suitable cartridge in a quick and safe manner.

METHOD OF AND APPARATUS FOR STEERING VESSELS.—J. F. KEY, care of Gen'l Delivery, San Francisco, Cal. This invention is an improvement in method and apparatus for steering vessels, and consists in opposing fluid pressures relatively, automatically maintaining a balance of pressure between the engine pressures and their respective controlling pressures and utilizing the variations in pressures for governing the powers of the engines.

MIXING MACHINE.—K. ROSHOLT, care of Northwestern Steel and Iron Works, Eau Claire, Wis. This invention relates generally to concrete mixing machines and more particularly to means for discharging the mixture from the machine. It also provides means for furnishing the requisite amount of water or other liquid to the material within the machine. The mixer also embodies means for mounting the paddles which perform the mixing operation.

BUTTONHOLE MARKING MACHINE.—E. T. ADAMS, care of the Adams Mfg. Co., Portsmouth, Ohio. The purpose in this invention is to provide a device by means of which the buttonholes of shoes may be marked quickly and accurately with a minimum of labor. A

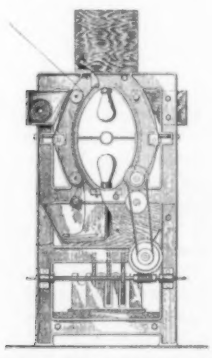


BUTTONHOLE MARKING MACHINE.

further object is to provide a machine which is self contained, all parts being carried by a single standard or upright, and which therefore takes up little room. The marker is of novel form, and means provide for simultaneously adjusting all the markers.

VIEW CHANGING DEVICE.—W. C. UPP, 30 Church St., New York, N. Y. This device will accommodate a large number of views, and will bring one view into position to be projected upon a screen, hold it in position for a predetermined time, and then permit the next view to be brought into position, this operation continuing so that all the views in succession are treated similarly.

ARTIFICIAL-LIGHT PRINTING MACHINE.—E. J. BROGAN, 23 Portland Place, Yonkers, N. Y. The improvement refers to devices for producing blue prints and the like, and the aim is to provide a machine arranged



ARTIFICIAL LIGHT PRINTING MACHINE.

to properly superimpose the sheets of tracing paper and the sensitive paper, and to cause the same to travel past a source of artificial light for making a proper exposure, and to finally separate the sheets of tracing paper and the exposed sensitive paper for removal from the machine.

HANDPIECE FOR DENTAL MACHINES.—C. E. NORTHROP, Thorsby, Ala. This invention refers particularly to a device which comprises a shell provided with a shaft, and means associated with the shell and shaft whereby a dental tool is held firmly on the shaft, and may be adjusted through the medium of the shaft in the shell.

CENTER SHAFT HEAD.—WALTER H. GREAVES, Stafford Springs, Conn. The invention comprehends a device by aid whereof the center shaft of a spinning mule may be readily connected with or detached from the head of a cylinder to be driven by said shaft, the parts being so formed and operated that the shaft and head are not readily disengaged except when the operator desires.

CAN.—J. L. JONES, Box 197, Maricopa, Cal. This invention provides mechanism in connection with a can wherein resiliency is required in the bottom of the can, as in oil cans and the like, wherein mechanism is provided within the can for insuring that the bottom of the can will always possess sufficient resiliency to insure the springing back or outward of the bottom after it has been repressed and the pressure has been relaxed.

PATTERN CONTROLLED SHEDDING MOTION.—W. SIMMCHEN, No. 42 Aussig-Kleische a. d. Elbe, Austria-Hungary. Up to the present time dobbies have been somewhat uncertain in operation and difficult to work. These drawbacks are entirely obviated by the present invention, and according to it one hook is fixed on each side of each heddle frame while the blades required for lifting and lowering the hooks are also arranged on each side of the heddle frames.

CUTTER FOR PAPER HOLDERS.—M. L. BENGSTON, Williams, Ariz. The invention provides an inexpensive device capable of attachment to existing holders without change in the holder itself, and wherein the cutting device is actuated by a continuation of the same movement that withdraws the paper from the holder.

PRESS.—P. L. SERWE, care of Serwe & Co., Inc., 109 Main St., Seattle, Wash. This improvement pertains to hand presses for pressing lard and other materials, and its object is to provide a press which is very simple, durable and exceedingly strong in construction to readily withstand the pressure to which the press is subjected during use.

MACHINE FOR FORMING BARREL STAVES.—F. M. KENNEDY, Clarendon, Ark. The invention refers to machines for forming barrel staves, and has reference more particularly to that class which, in forming the staves, extracts the sap from the surface of the staves by means of a pair of revolving rollers having the profile of a stave.

TYPEWRITER CABINET.—J. E. MARTIN, Kensington, Minn. A primary object of the invention is to provide novel details of construction for a cabinet, that adapt it for the safe and convenient disposal of a typewriter machine within the cabinet, so as to protect it from dust and improper handling, but permit its instant elevation into position for service.

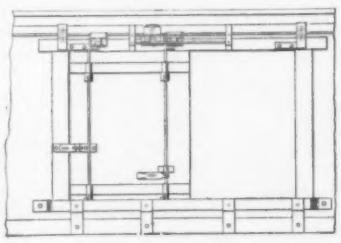
Prime Movers and Their Accessories.

MEANS FOR COOLING COMBUSTION ENGINES.—H. S. WHEELER, care of Far West Lumber Co., 102 S. 9th St., Tacoma, Wash. This inventor provides means for cooling the cylinder and piston of an internal combustion engine by the use of atmospheric air or other cooling medium. He uses means arranged inside of the cylinder and piston of the engine, to circulate a cooling medium through the means.

Railways and Their Accessories.

ADJUSTABLE CAR STEP.—J. H. VAUGHAN, 856 Palmetto St., Mobile, Ala. This invention comprehends more especially a small stair adapted to be mounted upon a car platform or other suitable portion of a car body, and provided with a step which, at the will of the operator, may be shifted into different positions relatively to the stair for the purpose of virtually lengthening and shortening the latter.

DOOR HANGER.—M. MOCK. Address D. B. Saffold, Beeville, Tex. This invention relates more particularly to sliding car doors, and the object is to provide a door, the movement of which will be free and easy. To this end the door has upper supporting stirrups carrying roller guided members and connected



DOOR HANGER.

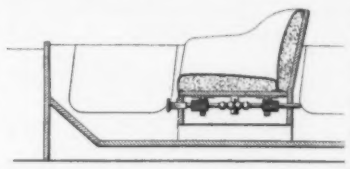
by a member which is movable freely through a roller carriage having a limited movement on the door frame. The engraving herewith shows an elevation of the side of a car, illustrating the practical application of the door thereto.

Pertaining to Vehicles.

POWER SHOVEL.—A. OFFERMANN, 435 W. 8th St., Davenport, Iowa. The invention comprises a long arm or lever, on the forward end of which a scoop is mounted, the lever being swiveled in a block or socket mounted on a crank shaft, the lever and scoop having suitable controlling devices, and means being provided to turn the crank-shaft to raise and lower the shovel, and means to propel the truck on which the shovel is carried.

INDICATOR.—T. G. FORTUNE and W. LOTRIDGE, care of Vitagraph Co., Santa Monica, Cal. This improvement comprises means for indicating in the daytime and at night the direction in which the vehicle is about to turn and the fact that it is about to come to a stop, and which also serves as a rear or tail light for the vehicle and as an illuminated license tag carrier.

ADJUSTABLE SEAT.—I. L. STANGER, Pensauken, N. J., and C. B. FITHIAN, Philadelphia, Pa. Address the former, care of A. Gentel, 1503 California Ave., Philadelphia, Pa. More particularly this invention relates to adjust-



ADJUSTABLE VEHICLE SEAT.

able and removable seats for use on vehicles and more especially to automobiles. The principal object is to provide a seat and means whereby it may be moved to different relative positions, thereby adapting it to the comfort and convenience of different people. The invention also provides a means for adjusting the seat relatively to its support which can be done in a short time, the parts being few and the operation simple.

ENGINE STARTER.—G. J. SPOHRER, care of Wilson Motor Starter Company, Franklin, Pa. The invention relates more particularly to means for "turning over" the internal combustion engine of an automobile. The device eliminates objectionable features of the old cranking means for "turning over" the engine by use of a compressed fluid. The engine is started by merely actuating a lever placed within convenient reach of the driver.

FOOT WARMER.—J. PHILIPCIK, JR., Box 168, New Canaan, Conn. The invention provides a warmer more especially designed for use in automobiles, aeroplanes, and other vehicles, and arranged to utilize the exhaust gases from the motor and to prevent overheating of the feet or burning of the shoes of the user.

Designs.

DESIGN FOR A GEM SETTING.—H. ACKERMAN, 51 Maiden Lane, New York, N. Y. This design is characterized by a scalloped form of gem setting which is very ornamental and attractive.

DESIGN FOR A FRUIT KNIFE.—E. B. LYDICK, 530 Sheridan Ave., Pittsburgh, Pa. In this ornamental design for a fruit knife the handle is beautifully scrolled. The blade is short and its curved lines produce a very original and graceful effect.

DESIGN FOR A GOBLET.—W. E. HUNTER, Morgantown, W. Va. In this ornamental design for a goblet the bowl is materially round with an attractive flange forming the rim. The stem is straight and slight which connects the bowl and the base.

DESIGN FOR A DRINKING GLASS.—C. GREER, 414 Greer Bldg., New Castle, Pa. The thin upper half of this glass is flared or turned outward, the lower and thicker half being rounded or convex, and a ridge or beveled shoulder is formed at junction of such parts, this constituting the most distinctive feature of the design.

DESIGN FOR A DOME-TOP TOILET POWDER CAN.—A. J. GUIDRY, New Orleans, La. Address Finlay Decks & Co., Magazine St., cor. Common St., New Orleans, La. The body of the can is cylindrical and is surmounted by a bulbous top whose greatest diameter is adjacent to its upper end, and such top is provided with a conical ornamental cap.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

MECHANICAL DRAWING. A Treatise on Technical Drawing as Expressed through the Medium of the Graphic Language. By Otho M. Graves. Easton, Pa.: The Chemical Publishing Company, 1912. 8vo.; 139 pp.; illustrated.

"Mechanical Drawing" is a well-ordered course of study in which certain vital principles have been held in mind. It aims to teach the grammar of the graphic language so interestingly as to awaken the creative faculty of design at the same time that the student is being trained to mechanical execution.

QUESTIONS AND ANSWERS ON THE PRACTICE AND THEORY OF STEAM AND HOT WATER HEATING. By R. M. Starbuck. Hartford, Conn.: R. M. Starbuck & Sons. 16mo.; 135 pp.; illustrated. Price, $1.

Mr. Starbuck has been very successful in compiling catechisms on sanitary plumbing, and this series of questions and answers on the subject of steam and hot water heating will no doubt prove acceptable to the trade. This fourth edition includes chapters on vacuum and vapor heating and accelerated hot water heating, with numerous tables, rules, and "tricks of the trade," and a wealth of miscellaneous information.

SOFT SOLDERING, HARD SOLDERING AND BRAZING. A Practical Treatise on Tools, Material and Operations. For the Use of Metal Workers, Plumbers, Tinners, Mechanics and Manufacturers. By James F. Hobart, M.E. New York: D. Van Nostrand Company, 1912. 12mo.; 190 pp.; 62 illustrations. Price, $1 net.

A glance through the detailed index will at once convince the reader of the astonishing amount of information conveyed by this little handbook. Soldering and brazing are operations constantly called for in a number of arts, crafts, and industries, and are by no means so easy of efficient accomplishment as is generally supposed.

THE MANUAL OF STATISTICS. Stock Exchange Hand-book. 1913. New York: The Manual of Statistics Company. 8vo.; 1104 pp. Price, $5.

This indispensable work of reference comes to us this year for the thirty-fifth time, as full and accurate as ever. Thumb-indexed, it makes immediately accessible a fund of information concerning the most important railroad, industrial, and government securities; it cites stock exchange quotations, high and low, for 1910, 1911, and 1912; and it concludes with production and price statistics of the various commodities of the world. In short, it is a manual without which the reference library of the man of business and the investor can scarcely be called complete.

THE GASOLINE AUTOMOBILE. Its Design and Construction. Vol. II. Transmission, Running Gear and Control. By P. M. Heldt. New York: The Horseless Age Company, 1913. 8vo.; 522 pp.; illustrated.

Continuing his exposition of automobile design and practice into this second volume, the author seeks to classify the various possible constructions of the different parts, giving formulæ for necessary dimensions, but avoiding descriptions of individual constructions so far as possible. The whole machinery of transmission, from friction clutch to road wheels, is most thoroughly and carefully exhibited in text and illustration. An appendix gives tables of loads and dimensions, and in conclusion are shown full-page photographic views of eight modern pleasure-car chassis.

THE GROCER'S ENCYCLOPEDIA. Compiled by Artemas Ward. New York: 50 Union Square. 4to.; 748 pp. Price, $10.

A more sumptuous book has rarely come to the reviewer's table. Its beauty is as great as "The Book of the Pearl." Every article of food and drink is elaborated on in a masterly manner and the wonder is how the compiler, or author as we should rather term him, gathered this vast aggregation of facts embellished with beautiful illustrations and a bewildering array of color plates largely from the objects themselves—fruit, vegetables, fish, meat, nuts, etc. The alphabetical arrangement heavily cross-referenced is wisely adopted. It is almost impossible to call attention to any one feature, the work being uniformly sustained, but the beautiful colored plates of cheeses is especially noteworthy. The actual machinery used in the preparation of food, such as cane mills, citrus fruit graders, fish wheels, etc., are much to be commended. It is to be hoped that grocers have given this book the support it deserves, as the exact knowledge it conveys is worth many times its moderate cost. As a work for the library, public or private, it can be recommended and its regular perusal will result in much pleasure. Mechanically the book is well-nigh perfect, paper, typography, color plates—everything is brought into rare harmony. A knowledge of the contents would post any housewife so that she would become a discriminating, if not an expert, buyer.

MAGNETO AND ELECTRIC IGNITION. By W. Hibbert, A.M.I.E.E. New York: Whittaker & Co., 1912. 16mo.; 154 pp.; 90 illustrations. Price, 70 cents net.

THE NEW BUILDING ESTIMATOR. By William Arthur. New York: David Williams Company, 1913. 8vo.; 729 pp.; illustrated. Price, $3 net.

The Ten Greatest Inventions of Our Time

We hear much of the great inventions of the past—the telegraph, the sewing machine, the telephone, the reaping machine, photography, Bessemer and open hearth steel, the steam engine and the phonograph. Yet the inventions of our own time are as epoch-making and as dramatic as these.

Perhaps because we have become accustomed to the use of the old machines and discoveries, perhaps because the achievements of latter-day inventors succeed one another so rapidly that we are not given much time to marvel at any one of them, we have not fully realized how stirring and wonderful are the products of modern ingenuity.

Only five years ago the man-carrying aeroplane made its first public flights; only the other day hundreds of passengers on a sinking ship were saved with the aid of wireless telegraphy. At least a dozen inventions as great have been perfected in our own time, and all of them have made a man's work count for more than it ever did before, and have made the world more livable than it ever was.

Why should we not tell the story of our own deeds?

Why should we not review the industries created by men who are still living, men whose names will go down into history with those of Watt, Morse, McCormick and Howe?

That was the underlying idea of the November Magazine Number of the Scientific American. We knew that the "ten greatest inventions of our time" was a big subject when first we planned the number, but how big it was we never realized until we surveyed the field of modern invention.

Then we saw how astonishing was the progress made in our own day, how much mankind had benefited by the inventions of great modern intellects. We began to appraise inventions, to weigh one against the other, and to determine in our own minds which ten had contributed most to human progress and happiness, which were really great pioneer inventions, and which merely remarkable and valuable improvements on successful past conceptions. There were so many achievements to consider that it was hard to arrive at a definite conclusion.

The upshot of our own thinking has been to leave to our readers the decision

What Are the Ten Greatest Inventions of Our Time, and Why?

For the Three best articles on the subject, we offer in the order of merit, three cash prizes:

First Prize: $150.00 for the best article
Second Prize: $100.00 for the second best article
Third Prize: $50.00 for the third best article

See last week's issue of Scientific American for conditions of contest.

Curious Resemblances in Nature

(Concluded from page 34.)

(represented by the head of the "swan"), where they are brought into contact with the essential, or sexual, organs. In this chamber the flies are held captive. Those which have come from other blooms bring pollen with them, and thus effect the pollination of the pistil. Then, when the stamens attain maturity, the whole company of imprisoned insects get dusted anew with pollen; and not until the flower fades, and the hairs in its throat wither, are they able to effect their escape.

Perhaps the most striking of all floral resemblances is that presented by the staminal column (the petals having been removed) of the Brazilian milkwort known as *Schubertia* (or *Araujia*) *grandiflora*. The likeness is that of a benevolent looking old gentleman, every feature being most perfectly portrayed; while, as the stalk, which supports the column is rotated from right to left between the fingers, the visage appears three times in succession—the right eye of one face becoming the left eye of the next, and so on. Of course this remarkable apparition is merely coincidental to the structure and coloring of the parts concerned. It has no direct bearing upon the adjustment of the flower to its environment. Nevertheless, it calls our attention to the unique arrangement of the essential organs which characterizes the natural order *Asclepiadaceae*. As in the case of the orchids, the pollen is combined to form masses which are torn away bodily by an insect of appropriate size and carried to another bloom. In the case of the *Schubertia*, the insect, coming to the flower for the nectar which it secretes, pitches upon the staminal column, and sooner or later gets its feet into the long, gaping slits—one of which is seen to each side of the mock face. As the insect attempts to escape, its feet are guided upward, and become wedged in a narrow notch in the black disks or "clips" (the "eyes" of the face), and can only be freed by tearing away the disks, together with the pair of pollen-masses attached to each. When large and powerful insects are involved, the device works to perfection; but small insects are quite unable to effect their escape, and are held captive by the flower until they die—a contretemps which defeats the object (i. e., cross-pollination) for which the whole elaborate contrivance exists. On this account these flowers are often spoken of as "cruel flowers" or "pinch-trap flowers." But when a powerful insect drags away a pair of pollen-masses, the latter undergo a remarkable twisting movement, by means of which they are brought close together. This facilitates their insertion into the stigmatic chamber of the next bloom which is visited by the insect. In the vicinity of these flowers one may often capture large wasps and other insects with large numbers of pollen-masses, or the clips from which the pollen has been detached, fixed firmly to their legs.

The very remarkable flower-spike, or inflorescence, of the sweet sedge (*Acorus calamus*) deserves mention because of its striking resemblance to a round file. The plant belongs to the order *Orontiaceae* (allied to the Arums), and is a native of Eastern Asia, although it has spread to other countries, and is conserved in Southern Russia, whence the rhizomes are exported. They yield an aromatic stimulant and tonic bitter, which is employed medicinally and for flavoring beverages. The inflorescence is a spike of small, closely crowded hermaphrodite blossoms which open in rotation from below upward. Self-pollination, or autogamy, is out of the question, because the stigmas of the individual flower fade before its anthers open. It is true that the stigmas of flowers in the upper part of the spike become receptive when the anthers of lower flowers are shedding their pollen; but as the pollen is adhesive, its transfer cannot be effected without the assistance of insects. Kerner informs us that in Europe, where the plant is not indigenous, it is always sterile. But farther east, where its flowers are visited by the right kind of insects, spikes of red berries are produced.

All children love to pinch the tightly closed jaws of the appropriately named "snap-dragon" (*Antirrhinum*). Lord Avebury aptly compares this flower to a "strong box to which the humble-bee only has the key;" for it is a fact that the smaller bees rarely succeed in forcing their way between the firmly closed lips of the corolla. The flower needs a large, long-tongued bee to bring about its cross-pollination. It is, indeed, a kind of tunnel, into which the insect visitor must crawl to reach the nectar which is secreted at its extremity. At the entrance of this tunnel, pressed against its roof, are the pollen-covered anthers, and an examination of the flower shows that small bees and other insects, could they gain access, would crawl down to pilfer the honey without touching the anthers at all. A large bee, on the other hand, fills up the tunnel, and inevitably brushes off some of the pollen with its hairy back. These facts explain the tightly-closed jaws of the snapdragon bloom, which call for a large, robust insect to force them apart.

Perhaps the most curious part of the snapdragon, however, is its irregular seed capsule. The accompanying photograph might pardonably be mistaken for a collection of skulls in some museum. Yet it really represents a few snapdragon pods mounted on pin-points. The three holes which seem to represent the eyes and mouth are, of course, the orifices through which the ripe seeds are ejected.

This article is not intended to furnish a complete list of curious resemblances which occur in nature, but merely to point out a few of the more striking, and to show how they may be utilized as aids in teaching. If the reader will exercise his own powers of observation and imagination, he will experience no difficulty in discovering a well-night endless series of subjects. In the patterns displayed by insect's wings many very diverting designs and pictures may be traced, four of which we illustrated. Perhaps the most striking of all is the "80" mark on the hind-wing of the South American butterflies called *Catagramma*. Of course the figures are not perfectly distinct in every species of the genus; but generally the hind-wing displays on its under-surface a more or less obvious "80" or "88." Hence, collectors in Brazil often term these butterflies "eighty-eights." The white markings on the thorax of the so-called "death's head" moths are also very impressive, being a very good imitation of a skull and cross bones, and reminding one of the insignia of a famous German cavalry regiment. In German Poland, where the moth is especially common, it is known by such names as the "death's-head phantom," and the "wandering death-bird," and is the object of much dread among ignorant peasantry. The great Indian "snake" moth (*Attacus atlas*) gets its name from the fact that the tip of each fore-wing suggests the head of an angry cobra seen in profile. Other moths of the same family have very curious and beautiful designs upon their wings, witness the "drooping bud" displayed on each fore-wing of the well known "moon" moth (*Actias luna*). These and many other patterns on the wings of butterflies and moths constitute a storehouse to which artists and designers might well go when they stand in need of inspiration. Indeed, certain conventional designs almost certainly trace their origin to the wings of insects. The famous Indian and Cashmere shawls, for example, reproduce in their patterns the colors and markings of butterflies which belong to the genus *Cethosia*.

As to the manner in which Nature produces these designs on the wings of butterflies and moths, the following brief description may be given—this being the really important point to which the transitory interest aroused by the designs themselves should be made to lead. The wing of an insect may be likened in its structure to a kite. It is a membrane stretched upon a supporting framework. Often this membrane is perfectly smooth and transparent to the eye, as in the case of a bee's wing; but frequently its surface is

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clothed with a more or less dense growth of hairs. Now these hairs Nature has taken in hand as her material for picture-making. But she has not left them as mere hairs. She has modified them in a wonderful way. Butterflies and moths make up the order Lepidoptera—a word made up from two Greek substantives which signify respectively a "scale" and a "wing." Why? Because the membranes of these insects' wings are clothed with a multitude of minute over-lapping scales. And these scales are really modified hairs. They grow out from the wing membrane in exactly the same way, while a complete series of transition from hairs to scales may often be found in a single species.

As to the manner in which this modification may have proceeded, we shall gain a fairly clear idea in the following way. Let us first think of a hair as a cylindrical bag closed at one end. If, now, we presume this bag to be formed of an expansive but non-elastic material, we realize that it could be readily inflated and flattened. By this process, in fact, the cylindrical hair could be converted into a flattened scale; and there is little doubt that in this way the scales of insects were derived. Attached to the wing membrane by short stalks, and looking like so many little battledores or rackets of innumerable queer forms, the scales are really flattened hairs.

Now among certain primitive insects which live in dry situations, scales seem to be useful as a means of retarding evaporation. The quaint little creatures known popularly as "silver ladies" or "silver fish" (*Lepisma*), which we find in our larders, may be instanced as an example. Their bodies are covered with a dense growth of beautiful silvery scales; and by this means a too rapid escape of moisture from the surface of the body is prevented. Indeed, none of the scaleless allies of the "silver ladies" can live long in a dry atmosphere; they literally shrivel up—Nature having intended them to dwell among moist surroundings. But in the case of butterflies and moths, no such purpose is served by the scales; so that we may regard them simply as a basis for the development of color and color patterns. Nature uses them, so to speak, as so many stitches in a tapestry of marvelous design.

German Inventors and Office Furniture

IN the report of an exposition for office furniture held in April at Frankfort, it is said that the exposition furnished convincing evidence of the increased interest taken among business concerns in Germany in improved office appliances and showed also that the German inventor and manufacturer is alert to the value of trade in such appliances and is equipping himself to secure a larger share of it than he has heretofore had. Referring to typewriter exhibits, it is suggested that much stress was placed on the various things that the machine can do aside from ordinary typewriting and that it is safe to say that German inventive effort will be directed along these lines and that much will be made of such improvements as selling points. If these features are of interest to German inventors, they should equally interest American inventors who have already done much to develop office appliances and particularly along the typewriter improvements.

The International Congress of Zoology

THE International Congress of Zoology was held recently at Monaco under the patronage of Prince Albert, whose eminent position in oceanographic work made this rôle doubly fitting. It will be remembered that the original promoters of zoology congresses were the French scientists Milne-Edwards and Blanchard. The congress is held every three years and assembled in the cities of Paris, Moscow, Cambridge, Berlin, Leyden, New York, Berne and Grätz. It is probable that in 1916 it will be held at Budapest and in 1919 at Rome.

The Industrial Need of Technically Trained Men—V

A Variety of Avenues Open to the Young Man of To-day

By A. B. Quincy

TO the boy leaving high school and looking about him for the best channel into which to direct his energies for the life before him, there are to-day a multitude of avenues open. We will suppose that he has decided to follow some walk in life which is based on one or other of the applications of science. This limits his choice somewhat, though not very greatly, for at the present day the majority of commercial and professional pursuits make more or less stringent demands for a training based upon scientific study. But what are the various sciences and their applications open to him? We will attempt no systematic order of enumeration. Suppose we begin with the biological sciences. There is botany, at the root of all plant culture. The farmer of to-day cannot afford to be ignorant of the fundamental principles of botany, and who has not heard of the wonderful achievements of Luther Burbank, based on an ingenious application of the principles of heredity, which we are only now beginning to understand? But it is not only in the cultivated field that the applied botanist finds work to do. The dendrologist, specialist in the botany of trees, takes care of our forests and tells us how to utilize their products to best advantage. Then there is the "plant doctor," akin to the veterinary surgeon, but giving his attention to plants instead of animals.

And as a special branch of botany there is bacteriology. We have heard so much of bacteria as breeders of disease that we are perhaps sometimes apt to forget that we have friends among them as well as foes. There are first of all the scavenger bacteria, without which we should be hard pressed to get rid of the sewage of our great cities. And there are bacteria in the soil, whose action is indispensable to the higher plants growing upon the soil. Again, we have a number of fermentation industries depending upon bacterial action—the manufacture of cheese, vinegar, beer, alcohol, and so forth.

The medical man is, of course, keenly interested in bacteria, not only as the cause of disease, but also the means for producing anti-disease sera, of which the diphtheria antitoxin is the shining example.

Zoology claims its own share of the prizes won by modern industries. Here also the application of the laws of heredity will in the future greatly assist the animal breeder in the proper selection of his stock. And that delicate balance which is struck in nature, keeping each species in its proper proportion, has been studied with important results in certain cases where some one species threatened to become an unmitigated pest, unless it were possible to find an enemy who would feed on that species and thus keep it within reasonable bounds.

Another of the natural sciences, geology, is commonly studied in conjunction with one or the other of the engineering sciences, although many will find it both pleasurable and to their advantage to specialize here. Geology finds many applications, not only in the mining of coal, ores, gems, building stone, and so forth, but also in civil engineering, wherever foundations have to be laid, a road built, or a water supply provided.

We have so far considered what might be called the "natural" sciences, as distinguished from the "experimental" sciences, such as physics and chemistry. All engineering is of course applied physics. But at the present day a number of special branches of engineering have come into being, which are rather more closely connected with the parent science, and therefore require a particular familiarity with the principles of physics. As examples may be mentioned telephony and telegraphy, both of the older type, and wireless.

But we have not exhausted the sciences. One of the most important, to the business man, we have not mentioned: economics. All business transactions fall into the province of this science, though it no doubt interests particularly the banker, the financier and the legislator. The truth is, no one should to-day be ignorant of the fundamental concepts of this science. Yet probably no science is so neglected.

In one special field this science has of late come into prominence, though its name is not often mentioned in this connection; namely, in efficiency engineering. The basis of all our actions is the endeavor to raise to a maximum the sum total of the pleasures which we can derive from our activities. Now one way to increase this pleasure is to either increase production without changing the labor required for it, or else to leave production unchanged, while decreasing the labor involved. The "efficiency" engineer has come to show us how to do this. The importance of his work rises *pari passu* with the ratio which the cost of labor bears to the cost of materials in the production of a given commodity. An example may serve to illustrate this. Suppose that for a certain article A the cost of material is $10, the cost of labor $1, and that the efficiency engineer steps in and reduces the labor item by one half, to 50 cents. The total cost of the article has been changed from $11 to $10.50, or by about 5 per cent. Now suppose that another article B costs $1 for material, and $1 for labor. If in this case the efficiency engineer reduces the cost of labor to 50 cents he has effected a saving of no less than 25 per cent! Anyone who has had anything to do with the manufacture of an article in which the cost of labor is the chief, or an important item, will fully appreciate the importance of this.

No attempt has been made here to even approach an exhaustive review of the different fields of applied science to which the young man looking out upon life may turn. In point of fact, though his principal attention may be given to one or other of these or of numerous others which we cannot stop to consider, no man can afford to allow "specialization" to degenerate into a mere narrowing down to one thing, and the modern man of affairs must have more or less familiarity with several—the more, the better—of these disciplines. It is generally found that the specialist worthy of the name knows a great deal more about fields outside his chosen one, than most others who do not claim to have specialized. And in framing his course of studies the young student will do well, so far as his means permit, to avoid premature specialization. Once a good solid foundation of general knowledge is gained, it may be very much to his advantage to select some one narrower field to which to pay special attention. And he may find it both congenial and profitable to steer somewhat off the old beaten tracks, and take up one of the newer developments of science. But in this he should be guided by the advice of some thoroughly mature and competent person.

New Director for the Leander McCormick Observatory

SAMUEL ALFRED MITCHELL, Ph.D., Professor of Astronomy at Columbia University, has been appointed director of the Leander McCormick Observatory at the University of Virginia. Prof. Mitchell has just spent a sabbatical year's leave from Columbia at the Yerkes Observatory, where his chief work has been the photographic determination of stellar parallaxes with the 40-inch telescope and also the spectrographic investigation of the motion of stars in the line of sight. At the University of Virginia, in addition to general visual work, Prof. Mitchell will make a special feature of photographic parallax work. Prof. Mitchell is well known to the readers of the SCIENTIFIC AMERICAN as a contributor.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12825) R. E. H. asks: Can you give me, through your columns or by letter, a formula for soap bubble solution? A. We do not know any better soap bubble solution than that made from good Castile soap, pure soft water, and glycerine. The book by C. V. Boys on "Soap Bubbles," which we send for $1, is still the best manual on this interesting subject. You will find interesting articles on soap bubbles in our SUPPLEMENT, Nos. 563, 579, 654, price ten cents each.

(12826) B. McD. asks: I would like to know if there is any other reason for the direction of the rotary flow of ocean currents besides the prevailing direction of the trade winds and the contour of the land they are blown against. A. There is a reason for the deviation of ocean currents other than the winds blowing over the surface of the water. 2. Why do all the ocean currents north of the equator flow in the direction of the movement of watch hands, and in the southern hemisphere in the opposite direction? A. It is a general law of the flow of fluids, water and air, over the earth's surface, that they are deflected to the right in the northern hemisphere and to the left in the southern, by the force of the earth's rotation upon its axis. See Waldo's "Elementary Meteorology," price $1.65 postpaid, under "General Circulation of the Atmosphere." It is in accordance with this law that the Gulf Stream is turned toward the east, and the Greenland Current toward the west along the eastern coast of America. 3. Is it a fact that water discharging out of a vessel through a round hole in its bottom assumes a rotary motion always in the direction of the ocean currents in the northern hemisphere? A. It is not a fact that water *always* rotates toward the right with us in flowing from an orifice in the bottom of a vessel. It frequently does, but if there is any irregularity in the opening, it may rotate in the opposite direction, or not rotate at all. 4. Why does water discharging from a round hole in the bottom of any container always assume a rotary motion? A. If there is any law in this matter, it is the same as given above. 5. Is the force of the winds now accepted as the cause of the ocean currents, and is the aggregate force of these currents greater or less than the aggregate force of the winds? A. The cause of the great ocean currents is the heat of the sun, which also is the cause of all winds.

(12827) C. A. E. H. asks: 1. If a so-called lightning arrester be placed on a building and connected by a copper cable to a suitable ground plate, is there a constant discharge of electricity from its point? A. We do not suppose there is a constant discharge of electricity across the air gap of a lightning arrester. There will be a discharge whenever the potential difference becomes high enough, but the usual potential is not sufficient to force a discharge across the gap. 2. If so, is there less electricity in the earth near the ground plate than in other places? That is, would the building be protected from lightning by, as it were, draining the electricity away from the earth below and around it? If this is not the case, the only protection which a lightning rod can afford must arise from its ability to carry off the electricity when struck by lightning. To do this efficiently would need a much greater capacity than the usual half-inch hollow cable possesses. A. No; there is not less electricity in the earth near the ground plate than in other places more remote from the plate. The electric potential of the earth is normally zero at all times, and any disturbance in a spot due to a ground plate is so slight that it cannot make any appreciable excess or deficiency in that spot. When a thunder storm is over a spot on the earth, the potential under the cloud rises to a high figure, and after a flash it falls again. The flash indicates the adjustment of the potential in the earth and in the cloud. 3. Would not the building then be in less danger of damage if the lightning rod were taken down and disconnected before each flash (or before the difference in potential between the point and a cloud above it was sufficient to cause a spark to pass)? A. We cannot assent to your proposition that a building is better protected without a lightning rod, nor that a half-inch cable is necessary. The U. S. Department of Agriculture last year issued a pamphlet upon Lightning Conductors, in which the use of a No. 3 iron wire is advised. The statement is made that the writer had never known a telegraph wire to be melted by a lightning flash, and a No. 3 wire is twice as heavy as the ordinary telegraph wire. It is about a quarter inch in diameter. A three eighths inch twisted wire cable would have about the same capacity. The document quoted is Farmers' Bulletin No. 367, and may be had from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a nominal price.

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